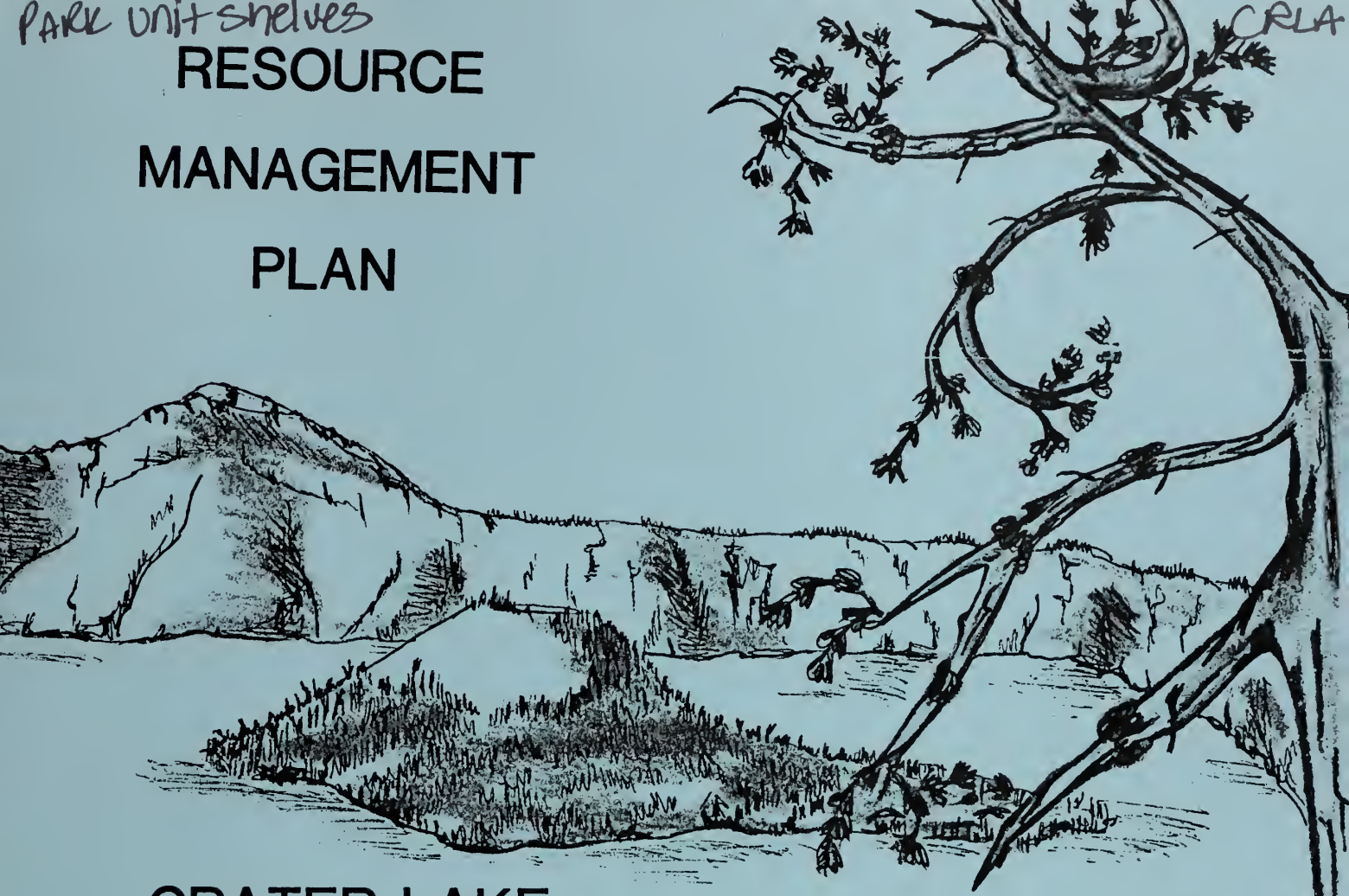
PARK unit shelves

CRLA

RESOURCE MANAGEMENT PLAN



CRATER LAKE NATIONAL PARK

NATIONAL
WATER RESO
FORT COLLIN
RESOURCE R

- P.E. GOLDBECK

NATURAL AND CULTURAL

RESOURCE MANAGEMENT PLAN
and
ENVIRONMENTAL ASSESSMENT

CRATER LAKE NATIONAL PARK

OREGON

1986

Recommended:

Robert L. Benton 2-20-86
Superintendent Date

Approved:

Wilbur J. Bright 2/28/86
Regional Director Date

NATIONAL
WATER RESO
FORT COLLI
RESOURCE R

Digitized by the Internet Archive
in 2012 with funding from
LYRASIS Members and Sloan Foundation

http://archive.org/details/naturalcraterlake00nati

FINDING OF NO SIGNIFICANT IMPACT
CRATER LAKE NATIONAL PARK
RESOURCE MANAGEMENT PLAN
AND
ENVIRONMENTAL ASSESSMENT

The Resource Management Plan and Environmental Assessment for Crater Lake National Park discusses proposed actions for managing the natural and cultural resources of the park.

The environmental consequences of the proposed actions are discussed in the Environmental Assessment portion of the plan. The Environmental Assessment indicates that no endangered or threatened species, floodplains, or wetlands would be adversely affected by the proposed actions. In addition, because the proposed actions regarding the cultural resources are conceptual, they have no potential impact on properties currently registered or eligible for the "National Register of Historic Places". Prior to the implementation of any cultural resource projects which may affect properties currently registered or eligible for the Register, the views of the Historic Preservation League will be requested and all applicable laws and regulations applied.

It has been determined that this is not a highly controversial Federal action that would cause significiant impact upon the quality of the human environment. This determination was based on the following: (a) the recommended alternatives will provide for the preservation and protection of natural and cultural resources in the park, (b) there will be no irreversible commitment of resources or irretrievable loss of resource productivity, (c) there would be no long term cumulative or secondary social, economic, or environmental effects, and (d) there are no endangered plants or animals, no cultural resources and no critical habitats that would be adversely affected. Thus an environmental impact statement will not be prepared.

Date 2/28/86

Approved Willis J. Bright
Regional Director
Pacific Northwest Region

TABLE OF CONTENTS

		Page No.
Map of Crater lake National Park		5
I. RESOURCE MANAGEMENT PROGRAM		6
A. Natural Resources Management Program		
1. Objectives		7
2. Primary Resources in Priority		7
3. Overview and Needs		10-28
4. Five Year Programming Sheet - Natural		29-30
5. Project Statements		31
CRLA-N-1	Basic Resource Inventory	32
CRLA-N-2	Caldera Ecosystem Management	35
CRLA-N-3	Bear Management	40
CRLA-N-4	Livestock Trespass	42
CRLA-N-5	Rare &/or Endangered Species-Animals	44
CRLA-N-6	Rare &/or Endangered Species-Plants	48
CRLA-N-7	Vegetation Management	50
CRLA-N-8	Pumice Field Management	54
CRLA-N-9	Hazard Tree Management	56
CRLA-N-10	Fire Management	57
CRLA-N-11	Air Quality	60
CRLA-N-12	Elk Management and Study	65
CRLA-N-13	External Influences	68
CRLA-N-14	Park Management and Visitor Use	72
CRLA-N-15	Integrated Pest Management	75
CRLA-N-16	Aquatics and Fisheries	78
B. Cultural Resources Management Program		
1. Major Historical Themes		81
2. Status of Planning and Documentation		84
3. Overview and Needs		85-92
4. Five Year Programming Sheet-Cultural		93
5. Project Statements		
CRLA-C-1	Rehabilitate Crater Lake Lodge	95
CRLA-C-2	Preserve Historic Structures	97
CRLA-C-3	Conserve Museum Collection	99
CRLA-C-4	(Combined under CRLA-C-3)	101
CRLA-C-5	Provide Oral History Documentation	102
CRLA-C-6	Compile Administrative History	104
CRLA-C-7	History of CRLA in the Conservation Movement	106
CRLA-C-8	Update Archeological Basemap and Overview	107

Page No.

II. PLAN PREPARATION, REVIEW AND DISK STORAGE 108

III. ENVIRONMENTAL ASSESSMENT MATRICES 109

1. Natural Resources 110-125

2. Cultural Resources 126-132

VI. APPENDICES

A. Crater Lake National Park Research Bibliography

B. Action Plans* Annual Update Date Approved

Fire Management Plan.....NO.....8/4/77
Bear Management Plan.....NO.....1/28/80
USFS Livestock Trespass Agreement.....NO.....3/29/79
Elk Management Plan.....N/A.....not done
Research Boat Operation Plan.....YES.....6/15/85
Hazard Tree Plan.....NO.....7/15/82
Lake Monitoring Plan.....YES.....6/85
Research Needs Plan.....YES.....9/84
Peregrine Falcon Plan.....YES.....3/85
Vegetation Management Plan.....NO.....6/84
Hydroseed plan.....YES.....5/85
Smoke Managment Agreement.....No.....6/79
Winter Lake Research Plan.....No.....12/85

* Action Plans may be amended, added or deleted without affect on the overall RMP as long as they conform to the approved, appropriate project statement.

I. RESOURCES MANAGEMENT PROGRAM

The Resource Management Plan outlines the strategies for protecting, perpetuating, and preserving natural and cultural resources of Crater Lake National Park (CRLA) as required by the enabling legislation of May 22, 1902 (32 Stat. 202). This legislation "dedicated and set apart (the park) forever as a public or pleasure ground for the benefit of the people... and ...for the preservation of the natural objects within said park..". This, coupled with the NPS Organic Act (35 Stat 535) and the subsequent legislation affecting CRLA and other National Parks, establish the purpose of the park to protect, preserve, and interpret the natural, scenic, and cultural resources of Crater Lake National Park in such a manner that those resources will be preserved for future generations.

The specific resources requiring protection are all those found within the 182,700 acres that comprise the park, with specific emphasis on Crater Lake, the deepest lake in the United States. This plan seeks to identify those resources in a systematic and orderly way, delineating their current status, pointing out potential and real threats to their preservation, describing current management strategies and constraints, identifying information deficiencies, and proposing a program that will ensure their preservation into the future.

This plan draws heavily on the CRLA General Management Plan and the CRLA Statement for Management as well as current NPS policies, congressional mandates, and established natural and cultural resource management practices, for the establishment of the following long term resource management objectives:

(from the 1983 CRLA Statement for Management)

1. Conservation of Natural Resources: To manage the natural resources of the Park in such a manner that the natural processes may occur with a minimum of influence from man's activities. Use and development be restricted to such areas and under such controls as to minimize the impact to sensitive park resources.

2. Research Program: To secure adequate information, through research or other means, to facilitate protection of park resources and management of visitor activities in ways that minimize impact on the park's environment.

3. Interpretation: To foster an understanding and appreciation of the sequence of natural forces that created Crater Lake and how these forces affect the environment and ecological communities. To provide information assistance appropriate for the safe, enjoyable and resource aware use of the park by the public.

6. Environmental Awareness: To promote environmental awareness by encouraging the use of the park by schools and other groups for environmental study.

9. Cultural Resources: To identify, evaluate, preserve, monitor, and interpret the park's cultural resources in a manner consistent with the requirements of historic preservation law and NPS policies.

A. Natural Resource Management Program

1. Objectives:

Crater Lake National Park is primarily a natural resource area, managed in such a manner as to allow natural processes to occur. The general guidance for CRLA natural resource policies are provided by the enabling legislation, the NPS Management Policies and Organic Act. The specific objectives are:

1. Identify and protect critical resources within the park with the highest priority being those related to the caldera ecosystem.
2. To allow, to the greatest extent possible, natural processes to occur, eg. wildlife, vegetation, soils, geology, and fire.
3. To foster a public awareness and appreciation for the park specific resources through interpretation and public contact.
4. To gather as much credible and scientifically valid information on park resources, through internal and external means, and to apply that information to management decisions.
5. To monitor activities adjacent or near to park boundaries and to work cooperatively with other agencies to minimize impacts on park resources.
6. To minimize visitor use impacts on park resources through public education and restriction of activities with potential of impact to areas of low sensitivity.
7. To minimize the impacts of park administrative activity by restricting those activities to areas of low sensitivity and concentrating development to pre-disturbed areas.
9. To correct and rehabilitate areas of previous use so as to restore them to natural appearance and processes.

2. Primary Resources in Priority:

The priority ranking of the management programs for park resources is based on the criteria of resource sensitivity, applicability of federal or state laws, congessional mandates, responsiveness to management programs, and the immediacy of a perceived threat. The following is listing of the general priority of park resources. This priority will change with time.

Caldera Ecosystem: Crater Lake is the prime resource of the park and the subject of the enabling legislation as well as PL 97-250. Management and protection of this unique resource involve both research into the caldera ecosystem and control of activities that may affect the lake. Research is on-going and and monitoring of the lake water quality should continue into the foreseeable future. Preliminary indications are that the lake is highly sensitive to increases of nutrients. All man-made sources of nutrients that may reach the lake will be investigated and then controled or eliminated. Human activites within the caldera will be limited to those necessary for visitor access at Cleetwood Cove, boat tours, day use on the island, and approved research. Human waste will be hauled out of the caldera. Rim Village sewage will be piped off of the rim to Munson Valley. Activities external to the park that have a possibility of

impact on the lake, such as geothermal development or air quality degradation, will be monitored closely.

Rare and Endangered Species: As required by the Endangered Species Act, CRLA takes an affirmitive role in identifying and protecting animals and plants listed by the USF & WS as Threatened or Endangered. An active program of reintroducing the peregrine falcon will continue at the park with the goal of establishing mating pairs. Surveys for nesting Bald Eagles will continue. The park will work cooperatively with adjacent agencies to identify habitiat for other species, not as yet listed but considered rare by state or federal standards. These include plants such as Botrychium pumicola and animals such as the spotted owl.

Air Quality: CRLA is a Class I area as defined by the Clean Air Act of 1977, as amended. Protection of the air quality as it relates to vegetation, visibility both inside and outside, and nutrient deposition into the lake is of prime concern to the park. Monitoring of particulates and visibility will continue in a cooperative effort with the state. Smoke produced by forest management practices both inside and outside the park will be of growing concern.

Fire Management: Fire is scientifically recognized as a part of the CRLA forest ecosystem. Historic suppression has created unnatural conditions. The park will continue to seek a balance of natural and prescribed fire to recreate and maintain natural conditions. The park will continue to work with neighboring agencies and the state concerning compatible policies and the management of smoke.

Basic Resource Inventory: CRLA has a rather poor basic resource inventory in all fields except water resources and geology. Vegetation has been documented via a thorough collection in the 1930's but has not been mapped adequately. Research into large animal populations has been minimal. The highest priority has been given to park elk due to impacts from forest management practices and hunting pressures on adjacent lands. Fisheries will be investigated as a part of the caldera ecosystem program. The park will seek to increase the park inventory of all resources through independent and park sponsored research. Priority for research and database collection will be given to those most sensive resources. All collected items will be incorporated into the museum collection and where possible the information will be computerized into a database. The use of a geographic information system will be investigated.

Park Management and Visitor use: The park takes an active approach to identifying areas of impact that are a result of current or past visitor or administrative use. Areas previously used, such as borrow pits, campsites, and administrative dumps, will be rehabilitated to a natural appearance. Areas in current use and still necessary, such as Munson Valley and the park road embankments, will be replanted and managed for native plant species and aesthetics. Visitor and administrative activities will be controlled so as to minimize impacts to those necessary for park operations and visitor access. When necessary, sociological studies will be initiated so the park can understand visitor attitudes and actions and tune its interpretive and signing programs

toward more efficient resource protection. In areas of current visitor use, a hazard tree program is used to identify and control tree hazards. Areas of special sensitivity, such as the caldera or the sphagnum bog, will have only controlled visitor activites.

Integrated Pest Management: The park considers native forest insects and pathogens an important part of the natural ecosystem and will not take action for control. The park will work colosely with adjacent agencies to monitor impacts for these on park forests. IPM programs have been developed for unnatural populations of species such as the golden mantled ground squirrel at Rim Village and pests such as carpenter ants that impact park facilites. Exotic plant species will be identified and physically controlled. Bear incidents in the campground will be minimized under an IPM program of visitor education, sanitary camping, and trapping if necessary.

Livestock Trespass: Grazing within the park is not permitted, though trespass livestock often enter the park from adjacent USFS and State lands. Impacts to park vegetation and competition with park wildlife is unknown. Prevention of trespass will pursued by working cooperatively with adjacent land management agencies and fencing of primary use areas along the park boundary.

Pumice Field Management: Off Road Vehicle (ORV) trespass on these fragile areas continues to be a problem primarily on the Pumice Desert. ORV traffic causes nearly irreparable damage to the sparse vegetation. Tracks from one trespass attact others. The park intends to construct barriers where necessary to prevent the intrusion.

3. Overview and Needs

This section represents a listing of the natural resource project accomplishments by fiscal year. These sections will be updated annually to reflect any accomplishments or changes in priority.

The funding identified for each program is identified by fiscal year and broken into three categories:

Current Funding: This category indicats the total funding from all sources the park is now using to implement the program, including all Resource Management staff salaries.

New Funding Needed: This category indicates the funding needed to implement the recommended Alternative(s). This column can be used each year to develop special resource funding requests.such as NRPP (Natural Resources Preservation Program). In each Overview and Needs section, the special funding requests such as NRPP will be noted with an asterik (*). In that this type if funding can be limited to three years, additonal funding indicated beyond the three years will be requested as a base increase.

Total Program: This category indicates the a sum of the "Current Funding" and the "New Funding Needed" columns. This represents the total necessary funding for a specific program.

Basic Resource Inventory (CRLA-N-1)

The recommended course of action for the CRLA basic inventory is to aggressively recruit independently funded researchers to investigate areas of particular interest to the management of park resources. The park will develop a computerized data base, a research bibliography and a geographic information system (GIS) The GIS will be developed through the CPSU at Oregon State University via a microcomputer link to the OSU Cyber mainframe. All items collected will be accessioned per Title 36 CFR 2.5(f). (See also CRLA-C-6, Collections Management).

Current Program and Funding Needs (thsds)

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program
86	Begin compilation of resource bibliography and oversee data collection:	0.0	0.0	0.0
	Personnel	3.8	0.0	3.8
		3.8	0.0	3.8
87	Continue compilation and start GIS database:			
	Personnel	3.8	0.0	3.8
	Digitize base maps	0.0	15.0*	15.0
		3.8	15.0*	18.8
88	Continue Compilation, digitize base map info. computer load bibliography:			
	Purchase digitizing tablet	0.0	5.0	5.0
	Personnel	3.8	0.0	3.8
	Purchase software	0.0	4.0	4.0
	Computer time	0.0	1.0	1.0
		3.8	10.0*	13.8
89	Continue compilation and computer loading data/GIS			
	Personnel	3.8	9.0	12.8
	Computer time	0.0	1.0	1.0
		3.8	10.0*	13.8
90	same as FY89	3.8	1.0**	4.8

* NRPP request
** Request for base increase

Caldera Ecosystem Management (CRLA-N-2):

The caldera ecosystem is the prime feature and attraction of Crater Lake National Park. The protection of this unique natural feature is mandated by PL 97-250 (Oct. 1982) with required investigation through 1992. The quality of the lake's water and lack of suspended particulates enables sunlight to penetrate to unususal depths and create the renowned blue coloration. The steep caldera walls generally prevent human impact on this sensitive resource. The caldera/lake ecosystem should be managed to minimize human influences within the caldera. Information is needed on lake characteristics to effectively make desisions and implement future action plans. An active research program is partially base funded and staffed. The Principal Investigator is located at the CPSU at OSU and oversees the monitoring and research program.

Fiscal Year	Description	Current Funding		New Funding Needed	Total Program
		CRLA BASE	CPSU		
86	monitoring	65.0	61.4	0	126.4
	water and nutirent budgets	0	17.2	0	17.2
	sedimentation	0	5.0	0	5.0
	lake color	0	4.6	0	4.6
	optical properties	0	0	25.0	25.0
	paleolimnology	0	0	0	0.0
		65.0	88.2	25.0	178.2
87	monitoring	65.0		50.0	115.0
	water and nutirent budgets	0		20.0	20.0
	sedimentation	0		5.0	5.0
	lake color	0		5.0	5.0
	optical properties	0		0.0	0.0
	paleolimnology	0		20.0	20.0
		65.0*		100.0**	165.0
88	monitoring	65.0		51.0	116.0
	water and nutirent budgets	0		20.0	20.0
	sedimentation	0		5.0	5.0
	lake color	0		6.0	6.0
	optical properties	0		0.0	0.0
	paleolimnology	0		20.0	20.0
		65.0*		102.0**	167.0

* Park Base
** NRPP request or Request to increase Park Base.

Caldera Ecosystem Management (CRLA-N-2): continued

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program
89	monitoring	65.0	52.0	117.0
	water and nutirent budgets	0	5.0	5.0
	sedimentation	0	5.0	5.0
	lake color	0	6.0	6.0
	optical properties	0	0.0	0.0
	paleolimnology	0	10.0	10.0
		65.0*	78.0**	143.0
90	monitoring	65.0	53.0	118.0
	water and nutirent budgets	0	5.0	5.0
	sedimentation	0	5.0	5.0
	lake color	0	7.0	7.0
	optical properties	0	0.0	0.0
	paleolimnology	0	0.0	0.0
		65.0*	70.0**	135.0

* Park Base
** NRPP request or request to increase Park Base

Bear Management (CRLA-N-3):

All indications from adjacent land managers, the Oregon Department of Fish and Wildlife and observational data are that local bear populations are stable or on the increase. The park will continue the distribution of bear informaion to park visitors, recommend the storage of food items in the campground, and control measures will be employed where necessary. The CRLA program will continue in accordance with the Bear Management Plan which will be updated as necessary. No new funding is necessary.

Current Program and Funding Needs (thsds)

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program
86	Implement Bear Plan, stock of Immobilization supplies and Personnel time	1.0	0.0	1.0
87	"	1.0	0.0	1.0
88	"	1.0	0.0	1.0
89	"	1.0	0.0	1.0
90	"	1.0	0.0	1.0

Livestock Trespass (CRLA-N-4):

There is no authorized livestock grazing within CRLA. Historically some trespass has occurred from animals grazing on USFS lands to the west and east of the park. In 1980, PL 96-553 added 22,890 acres of USFS land to the park. These lands were previously grazed by domestic livestock, though with their addition to the park they are now removed from authorized grazing. The new west boundary is grazed by domestic cattle and the USFS lands on the east are grazed by domestic sheep. The recommended course of action is to develop an Interagency Agreement with the USFS concerning livestock trespass. Then an Interagency funded project of fencing will occur in critical areas. Sensitive plant species will be surveyed for impact.

Current Program and Funding Needs (thsds)

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program
86	Patrol boundary, negotiate Interagency Agreement	1.5	0.0	1.5
87	Finalize Interagency Agreement (Personnel) Identify areas of concern, design fence and materials purchase	1.5	10.0*	11.5
88	Personnel	1.5	0.0	1.5
	Construct fence(s)	0.0	10.0	10.0
	Survey plants	0.0	5.0	5.0
		1.5	15.0*	16.5
89	Personnel	1.5	0.0	1.5
	Construct fence	0.0	10.0	10.0
	Survey plants	0.0	5.0	5.0
		1.5	15.0*	16.5
90	Personnel	1.5	0.0	1.5
	Monitor area	----	2.0	2.0
		1.5	2.0**	3.5

* NRPP request
** Request for increase to base

Rare and/or Endangered Species - Animals (CRLA-N-5):

The protection of endangered species and the related environment is mandated by Congress. Crater Lake National Park has the only known nesting peregrine falcons in the state of Oregon. Data has been compiled in the preparation of a management action plan to assist in the reproductive success of the peregrine falcon within the park. This program is recommended to continue.

Bald eagles have historically nested within the caldera. Little is presently known about the nest sites, reproductive success, or habitat requirements. Additional information will be necessary to assess impacts from possible development in the Rim Village area, i.e. extensive Lodge rehabilitation, construction of a Visitor Center and rerouting of traffic flow.

Columbian white tailed deer, the gray wolf, and spotted owls have been reported in the park. Management needs specific data on population, distribution and habitat to take necessary actions for their preservation.

Current Program and Funding Needs (thsds)

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program
86	Continue Peregrine Falcon Program			
	(1) Seasonal	4.7	0.0	4.7
	(2) RM staff (part time)	4.5	0.0	4.5
	Nest site/hacking	5.2	0.0	5.2
		14.4	0.0	14.4
87	Continue Peregrine Program			
	As '85	14.4	0.0	14.4
	Survey for Bald Eagles	0.0	3.0	3.0
	Survey for Spotted Owls	0.0	2.0	2.0
		14.4	5.0*	19.4
88	Continue Peregrine Program			
	As '87	14.4	0.0	14.4
	Survey for Bald Eagles	0.0	3.0	3.0
	Survey for Spotted Owls	0.0	2.0	1.0
		14.4	5.0*	19.4
89	Continue as '88	14.4	5.0*	19.4
90	Continue as '89	14.4	5.0*	19.4

* NRPP request
** Request for increase to base

Rare and/or Endangered Species - Plants (CRLA-N-6):

It is recommended that the annual surveys of Botrychium pumicola continue. Conduct surveys for specific rare plant species, with particular emphasis on new lands added by PL 96-553 (Dec., 1980). Outside researchers will be encouraged to survey for rare species. All species considered rare by Oregon standards will be protected. All areas planned for development will be surveyed for rare species prior to construction.

Current Program and Funding Needs (thsds)

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program
86	Personnel	2.0	0.0	2.0
	conduct surveys and protect	0.0	8.0	8.0
	critical habitats	2.0	8.0	10.0
87	Personnel	2.0	0.0	2.0
	conduct surveys and protect	0.0	8.0	8.0
	critical habitats	2.0	8.0*	10.0
88	Personnel	2.0	0.0	2.0
	conduct surveys and protect	0.0	8.0	8.0
	critical habitats	2.0	8.0*	10.0
89	Personnel	2.0	0.0	2.0
	conduct surveys and protect	0.0	8.0	8.0
	critical habitats	2.0	8.0*	10.0
90	Personnel	2.0	0.0	2.0
	conduct surveys and protect	0.0	8.0	8.0
	critical habitats	2.0	8.0**	10.0

* NRPP request
** Request for increase to base

Vegetation Management (CRLA-N-7):

It is recommended that all previously impacted areas be surveyed and assigned a priority for rehabilitation. Hydroseed road cuts under a cyclic maintenance program. Narrow trails to foot path width. Remove asphalt from south entrance road repavements. Rehabilitate specific areas as identified by priority listing.

Current Program and Funding Needs (thsds)

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program
86	Personnel	2.0	0.0	2.0
	Survey impact areas			
	Rehab. impact areas	0.0	75.0	75.0
		2.0	75.0*	77.0
87	Personnel	2.0	0.0	2.0
	Hydroseed selected areas	25.0	0.0	25.0
	Rehab. impact areas	0.0	75.0	75.0
		27.0	75.0*	102.0
88	Personnel	2.0	0.0	2.0
	Survey Impact areas			
	Rehab. impact areas	0.0	75.0	75.0
		2.0	75.0*	77.0
89	Personnel	2.0	0.0	2.0
	Hydroseed S. Ent. Rd.	25.0	0.0	25.0
	Monitor work/rehab areas	0.0	5.0	5.0
		27.0	5.0**	32.0
90	Personnel	2.0	0.0	2.0
	Monitor work/rehab areas	0.0	5.0	5.0
		2.0	5.0**	7.0

* NRPP request
** Request for increase to base

Pumice Field Management (CRLA-N-8):

Human activities, primarily illegal off-road vehicle use, intrudes annually into fragile pumice fields. Natural regeneration is very slow in these areas and evidence of human encroachment can be seen for many years. The Pumice Desert, along the North Entrance Road, receives the highest visitor use and off-road vehicle (ORV) abuse of all park pumice fields. Each year new tire tracks can be seen leading from the road into the Pumice Desert. Other pumice fields receive such use but to a lesser degree.

It is recommended that to protect the fragile environment of the pumice desert, a low barrier be constructed to deter ORV's. Some vegetation surveys may be recommended.

Current Program and Funding Needs (thsds)

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program
86	Design and construct barrier	0.0	16.0*	16.0
87	barrier maintenance	0.0	2.0*	2.0
88	Barrier maintenance	0.0	2.0*	2.0
89	Barrier maintenance	0.0	2.0**	2.0
90	Barrier maintenance	0.0	2.0**	2.0

* NRPP request
** Request for increase to base

Hazard Tree Management (CRLA-N-9):

There have been only a few minor reported incidents of tree failure and resulting damage within the park. The principal areas of concern are: Munson Valley, Mazama Campground, Lost Creek Campground, Rim Village, and the paved road and its associated pull-outs. The park has a responsibility to survey, identify, and remove hazard trees.
It is recommended to implement the CRLA Hazard Tree Plan, which requires annual surveys for trees that have potential for damage to person or property. The Plan will be updated as necessary and a record will be kept of all trees removed.

Current Program and Funding Needs (thsds)

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program
86	Personnel	2.0	0.0	2.0
87	"	2.0	0.0	2.0
88	"	2.0	0.0	2.0
89	"	2.0	0.0	2.0
90	"	2.0	0.0	2.0

Fire Management (CRLA-N-10):

Fires have been suppressed within CRLA since its establishment in 1902. This activity has altered the forest composition within certain areas of the Park, causing unnatural fuel loading, unnatural stand composition and densities, and possibly altering wildlife use of the area. For the purposes of the park fire management program, the Park can be broken down into the forest types of mountain hemlock, lodgepole pine, and ponderosa pine. All of these forest types have differing fire regimes. The recommended fire management program will be an update of the CRLA Fire Management Plan to identify areas for prescription, and delineate natural, conditional and prescribed fire zones. Natural fires will be monitored per plan. Prescribed fires will be used as vegetation management tools in the ponderosa pine/white fir forest complex to re-create natural conditions.

Current Program and Funding Needs (thsds)

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program
86	Continue program	26.0	0.0	26.0
	Begin burning Yawkey Tract	0.0	45.0	45.0
		26.0	45.0*	71.0
87	Continue program including Yawkey Tract	26.0	0.0	26.0
		0.0	45.0	45.0
		26.0	45.0*	71.0
88	same as '87	26.0	45.0*	71.0
89	begin maintenance burning update FMP	26.0	15.0**	41.0
90	maintenance burning	26.0	15.0**	41.0

* NRPP request
** Request for increase to base

Air Quality (CRLA-N-11):

CRLA will continue its Air Quality monitoring program for visibility and fine particulates. A year-round automated teleradiometer will be installed at Rim Village. An air quality monitoring shelter will be incorporated into existing or new development at Rim Village to house NPS and State equipment. Periodic snow analysis will be conducted. A quanitative analysis of Air Quality Related Values will be completed.

Current Program and Funding Needs (thsds)

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program
86	Continue program			
	Locate new AQ monitoring site at Rim Village.	4.5	0.0	0.0
	Install auto. teleradiometer	0.0	2.0	2.0
		4.5	2.0	6.5
87	Continue program	4.5	0.0	4.5
	Rim wiring to new AQ site	0.0	2.0	2.0
	at Rim Village	0.0	0.0	0.0
	Operate automated system	0.0	2.0	2.0
		4.5	4.0	8.5
88	Continue program	4.5	0.0	4.5
	Install new AQ site	0.0	5.0	5.0
	Operate automated system	0.0	2.0	2.0
		4.5	5.0	11.5
89	Operate program at new site	5.0	2.0**	7.0
90	same as '89	5.0	2.0**	7.0

* NRPP request
** Request for increase to base

Elk Management (CRLA-N-12):

The recommended course of action is to discontinue the plot pellet counts and continue the comprehensive elk population study. The study began in 1985 with radio collaring of elk in cooperation with the Oregon Dept. of Fish and Wildlife. The current program is funded through the NRPP PNR multipark project of Ungulate Ecology and Management. Future program direction and funding requests will be based on results of the current study. Information will be gathered concerning elk productivity seasonal movements, vegetation use and park distribution.

Current Program and Funding Needs (thsds)

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program
86	Park staff support	1.0	0.0	1.0
	Elk study funded by OSU-CPSU	34.0	0.0	34.0
		35.0*		35.0*
87	Personnel Evaluation of data and redirection of program	1.0	0.0	1.0
88	Unknown until results of 85-86 study complete.			
89	"			
90	"			

* NRPP funding

External Influences (CRLA-N-13):

It is recommended that park staff participate in the environmental analysis and review, and provide comments and technical assistance to adjacent land management agencies in proposals for external activities that have potential to impact park resources. Additionally, in case of high impact such as the geothermal development, the park will take an active role in monitoring park resources in response to those impacts. Request for NRPP funding will be directed to the quantification of the hydrothermal system on the bottom of Crater Lake and it possible impacts from geothermal development.

Current Program and Funding Needs (thsds)

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program
86	Staff time	2.7	0.0	2.7
	Monitor geothermal	0.0	35.0	35.0
	impacts	2.7	35.0*	37.7
87	same as '86	2.7	35.0*	37.7
88	same as '87	2.7	35.0*	37.7
89	same as '88	2.7	35.0**	37.7
90	same as '89	2.7	35.0**	37.7

* NRPP request
** Request for increase to base

Park Management and Visitor Use (CRLA-N-14):

It is recommended that visitor use patterns and administrative needs be weighed with resource concerns in the development of new facilities and visitor management strategies. Where information is lacking, sociological studies may be required.

Current Program and Funding Needs (thsds)

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program
86	Staff time	2.0	0.0	2.0
87	Staff time	2.0	0.0	2.0
88	Staff time	2.0	0.0	2.0
89	same as '88	2.0	0.0	2.0
90	same as '89	2.0	0.0	2.0

Integrated Pest Management (CRLA-N-15):

It is recommended that the principles of IPM be applied to all pest problems at CRLA with the developmenmt of IPM action summaries for each pest problem. Pest problems at CRLA can be divided into the following areas:

1) Mountain Pine beetle and other forest insects found in park forests,
2) Rodents and plague: The potential is great for ground squirrel populations particularily in Rim Village area where visitor ground squirrel contacts are frequent,
3) Structural pests include household insects such as carpenter ants, and vertebrate pests such as rodents,
4) Exotic plants such as mullein are found on road shoulders and disturbed sites.

A contracted structural pest survey for all structures is recommended. A combination of enforcement and plague warning signs will be used at Rim Village with other methods of plague information given to the public via bulletin boards. Ground squirrels will be excluded from consessioner food preparation areas through contract compliance.

Current Program and Funding Needs (thsds)

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program
86	Staff time for surveys and trapping	.5	0.0	.5
	Mountain Pine Beetle	0.0	7.0	7.0
	study of GMGS	0.0	3.0	3.0
		.5	10.0*	10.5
87	Staff time for surveys and trapping	.5	3.0	3.5
	Mountain Pine Beetle	0.0	7.0	7.0
	study of GMGS	0.0	3.0	3.0
		.5	10.0*	10.5
88	same as '87	.5	3.0	3.5
	Mountain Pine Beetle	0.0	7.0	7.0
	study of GMGS	0.0	3.0	3.0
		.5	10.0*	10.5
89	same as '88	.5	0	.5
	Monitor IPM program	0	5.0	5.0
		.5	5.0**	5.5

Integrated Pest Management (CRLA-N-15): continued

Current Program and Funding Needs (thsds)

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program
90	same as '89	.5	0.0	0.5
	Monitor IPM program	0.0	5.0	5.0
		.5	5.0**	5.5

* NRPP request
** Request for increase to base

Aquatics and Fisheries (CRLA-N-16):

It is recommended that the USGS be encouraged to continue their program of monitoring springs around CRLA. The voluntary creel census would continue with the addition of periodic gill netting surveys. A survey/study of the impacts on Munson/Dutton Creeks for impacts related to park use was initiated in 1985 and the final report is due in 1986. An investigation would be initiated to explore the relationship of fish in Crater Lake to the caldera ecosystem.

Current Program and Funding Needs (thsds)

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program
86	Staff time	1.0	0.0	1.0
	Creel Census	.4	0.0	.4
		1.4	0.0	1.4
87	Staff time	1.0	0.0	1.0
	Creel census	.4	0.0	.4
		1.4	0.0	1.4

88, 89, and 90 Request dependent on results of Munson/Dutton Creek study and also the fish study.

NATURAL RESOURCE MANAGEMENT PLAN
FIVE YEAR PROGRAMMING SHEET

Date: 12/22/85 PAGE 1 OF 2

CRLA PARK | PNR REGION | OREGON State | ___x___NATURAL

Action Type: M=maintenance, P=protection, O=monitoring, R=research

Funding source: P.B.= Current park base, NRPP= Request for funding from NRPP, ONPS= Request for increase to park base, RNRB= Regional Multipark projects CPSU= Cooperative Park Study Unit, CYCL= Cyclic Maintenance.

AREA PRIORITY	RMP NO.	PACK NO.	PROJECT TITLE	ACTION TYPE* R,M,O,P	FUND SOURCE	86 NPS MY	86 COST/ THSDS$	87 NPS MY	87 COST/ THSDS$	88 NPS MY	88 COST/ THSDS$	89 NPS MY	89 COST/ THSDS$	90 NPS MY	90 COST/ THSDS$
1	CRLA-N-2	--	Caldera Ecosystem Management	O	P.B.	2.50	65.00	2.50	65.00	2.50	65.00	2.50	65.00	2.50	65.00
				O,R	CPSU		88.20								
				O,R	ONPS				100.00		102.00		78.00		70.00
2	CRLA-N-13	--	External Influences	O	P.B.	0.10	2.70	0.10	2.70	0.10	2.70	0.10	2.70	0.10	2.70
				O,R	NRPP		35.00		35.00		35.00				
				O,R,P	ONPS								35.00		35.00
3	CRLA-N-5	--	Rare &/or Endangered Animals	O,P	P.B.	0.56	14.40	0.56	14.40	0.56	14.40	0.56	14.40	0.56	14.40
				O,R	NRPP			0.40	5.00	0.40	5.00	0.40	5.00		
				O,P	ONPS									0.40	5.00
4	CRLA-N-11	--	Air Quality	O	P.B.	0.32	4.50	0.32	4.50	0.32	4.50	0.32	4.50	0.32	4.50
				O	NRPP		2.00		4.00		7.00				
				O	ONPS								2.00		2.00
5	CRLA-N-10	--	Fire Management	M,O	P.B.	1.24	26.00	1.24	26.00	1.24	26.00	1.24	26.00	1.24	26.00
				M,P,O	NRPP	1.50	45.00	1.50	45.00	1.50	45.00				
				M,O	ONPS							1.50	45.00	1.50	45.00
6	CRLA-N-12	--	Elk Management	O,R	P.B.	0.20	1.00	0.20	1.00	0.20	1.00	0.20	1.00	0.20	1.00
				O,R	RNRB		34.00								
				O	ONPS			Funding request dependent on study results							
7	CRLA-N-1	--	Basic Resource Inventory	M,O	P.B.	0.05	3.80	0.05	3.80	0.05	3.80	0.05	3.80	0.05	3.80
				R	NRPP			0.50	15.00	0.40	10.00	0.40	10.00		
				M,O	ONPS									0.40	10.00
8	CRLA-N-16	--	Aquatics and Fisheries	O	P.B.	0.05	1.40	0.05	1.40	0.05	1.40	0.05	1.40	0.05	1.40
								Funding request dependent on study results.							

29

CRLA PARK | PNR REGION | OREGON State | ___x___NATURAL

Action Type: M=maintenance, P=protection, O=monitoring, R=research

Funding source: P.B.= Current park base, NRPP= Request for funding from NRPP, ONPS= Request for increase to park base, RNRB= Regional Multipark projects CPSU= Cooperative Park Study Unit, CYCL= Cyclic Maintenance.

AREA PRIORITY	RMP NO.	PACK NO.	PROJECT TITLE	ACTION TYPE* R,M,O,P	FUND SOURCE	86 NPS MY	86 COST/ THSDS$	87 NPS MY	87 COST/ THSDS$	88 NPS MY	88 COST/ THSDS$	89 NPS MY	89 COST/ THSDS$	90 NPS MY	90 COST/ THSDS$
9	CRLA-N-7	--	Vegetation Management	O	P.B.	0.10	2.00	0.10	2.00	0.10	2.00	0.10	2.00	0.10	2.00
				M	CYCL				50.00				50.00		
				M,R,O	NRPP	0.50	75.00	0.50	75.00	0.50	75.00				
					ONPS									0.10	5.00
10	CRLA-N-9	--	Hazard Tree Management	M	P.B.	0.10	2.00	0.10	2.00	0.10	2.00	0.10	2.00	0.10	2.00
11	CRLA-N-6	--	Rare &/or Endangered Plants	M	P.B.	0.10	2.00	0.10	2.00	0.10	2.00	0.10	2.00	0.10	2.00
				R	NRPP	0.40	8.00	0.40	8.00	0.40	8.00				
				M,P	ONPS							0.40	8.00	0.40	8.00
12	CRLA-N-14	--	Park Mgmt. and Visitor Use	O	P.B.	0.10	2.00	0.10	2.00	0.10	2.00	0.10	2.00	0.10	2.00
13	CRLA-N-15	--	Integrated Pest Management	M,O	P.B.	0.05	0.50	0.05	0.50	0.05	0.50	0.05	0.50	0.05	0.50
				M,O,R	NRPP	0.30	10.00	0.30	10.00	0.30	10.00				
				O	ONPS							0.30	5.00	0.30	5.00
14	CRLA-N-3	--	Bear Management	O	P.B.	0.07	1.00	0.07	1.00	0.07	1.00	0.07	1.00	0.07	1.00
15	CRLA-N-4	--	Livestock Tresspass	O	P.B.	0.10	1.50	0.10	1.50	0.10	1.50	0.10	1.50	0.10	1.50
				M,P	NRPP			0.20	10.00	0.20	15.00	0.20	15.00		
				O	ONPS									0.07	2.00
16	CRLA-N-8	--	Pumice Field Mgmt.		P.B.										
				M,P	NRPP	0.20	16.00		2.00		2.00				
				M	ONPS								2.00		2.00

2. Natural Resources Project Statements

The following project statements describe in detail the status of information, the current management actions, the nature of the natural resources to be protected and all realized and potential threats to those resources. The project statement reviews alternative actions, their environmental and social consequences, and recommends a proposed action. These project statements are intended to be updated as needed. The project statement number, such as CRLA-N-1, does not necessarily represent a numerical priority as the priority may change over time. The project statement number should not be changed so as to provide a tracking system for each project for future years. As new projects are identified, they should be assigned new numbers and added to the overall list.

In some cases, individual projects are too elaborate to be completely detailed in this section and will appear only as summarizations. The program will then be detailed more specifically in a subsequent Action Plan.

CRLA-N-1: Basic Resource Inventory

Statement of Issue:

This project outlines the need and direction for establishment of an inventory of the status of the natural resources of CRLA. To ensure that sound principles of natural resources be applied by park management, a database needs to be established from which to draw information about the status of the biological, geological, physical and sociological resources of the park. Without such an inventory, or without an ability to draw together existing knowledge, management practices may be less than optimal.

Currently, decisions regarding natural resources are often made without adequate data or with insufficient research analysis. Priorities of data gathering and research have not been established and collection efforts are random. Independent research is regularly conducted but the topics are selected by the requesting collector/researcher based on their interests, with little involvement from the park. Research information collected is retained in hard copy in park files and is often forgotten when it coincidently relates to some park management action. Park mapable information is occasionally recorded on mylar overlays at 1:62,500 scale and stored in park files. This system allows some overlaying but is labor intensive and limiting in its capabilites for analysis of geographical relationships.

The park maintains a museum collection. Items collected by staff or visiting researchers have not been incorporated into the park collection as per NPS 28 and Title 36 CFR 2.5 (f). Items have been lost, stolen, or misplaced in the past. (See CRLA-C-3.)

To establish a permanent record of the park resources and to have accessible information for management decisions, a systematic program of resource information identification, collection, storage and retrieval needs to be established. This includes the reproduction, archival and storage of data collected in park researce related research. Many of the project statements in this plan relate to park research. All data collected must be stored for future reference.

Alternative Actions and Their Probable Impacts:

A. No Action (Current Action): Under this alternative, the park would continue to take a passive role in monitoring its resources. Research would be programmed only for those "visible" problems. Research by outside agencies or universities would be passively encouraged and specific research needs would not be identified. No housing, monetary, and little staff support would be provided to visiting, independently funded researchers. Data collected is filed under appropriate headings for future reference by topic. Collections made by visiting researchers are not accessioned into the park collection. Park staff continues to collect information on wildlife via "observation cards" and this information is annually summarized and reported. Some small in-house studies may be conducted by staff on an as needed basis. In-park wildlife collections are limited to "dead on road" finds.

Impacts: This alternative does not provide the necessary information for sound management decisions. In many cases, with no previous information, a decision must be made before adequate data can be collected. This alternative would not allow the anticipation of such decisions and the start of data collection by in-house or ouside means. The result could be loss or damage to sensitive resources. This alternative also does not address the requirements of 36 CFR 2.5 (f), which prohibits the killing of any park wildlife or plants for the purposes of scientific collections.

B. Alternative B - Park takes an active role in research needs identification: Under this alternative, the park would take an active role in identifying research needs and encouraging in-house and outside researchers to develop the park database. The park will develop an " Annual Research Needs Plan" that will identify deficiencies in the park data base on specific resources. Through the base funding process, special programs, and through outside universities, the park will encourage and seek funding, where possible, for the research of these subject areas. The park will continue to use "observation cards" and collect "dead on road" finds. All research requests by independently funded researchers and Collection Permits will be carefully evaluated against the "Research Needs Plan" and the overall information database of the park.

Once a specific research need is identified within the "Research Needs Plan" or a specific need for the park collection is identified in the Scope of Collections, then independent research or collection within these areas will be allowed and encouraged. Independent researchers will then be issued a Collection Permit and be considered "collaborators" with the National Park Service and meet the requirements of 36 CFR 2.5. All collection permits not meeting the requirements of the park's research needs or those that may be fulfilled outside of the park will be denied. All items collected by the NPS or by independent researchers will be accessioned and cataloged into the park collection per 36 CFR 2.5 and NPS 28.

All existing information on park resources, all bibliographic references, and all data references collected in the future will be loaded into an accessible computer program on the park's micro-computer. Data that can be geographically referenced will be collected and recorded in such a manner as to eventually form a geographic information system for the park. The park will work with the USGS, the NPS Geographic Information Systems Field Unit in Denver, and Oregon State University to develop a geographic information system (GIS) for the park.

Impacts: This alternative will provide a system for identifying needed research and protecting natural resources through a thorough and retrievable data base. The computerization of the information and the GIS will assist in more rapid retrieval of the information. Identification of the research and collection needs will assist the park in making resource decisions in the future by having the information already collected. The legal requirements of Title 36 CFR 2.5 will be met. There may be an overall reduction in the research and data collection within the park by denial of Collection permits that do not pertain to park resource needs.

Recommended Course of Action: It is recommended that Alternative B be implemented. A No Action alternative, while requiring less administration by the park, will not satisfy the needs of a research base upon which to make sound management decisions. A passive approach to research will only through coincidence provide that data often urgently needed. Alternative B will, through assistance from subject experts, identify CRLA data deficiencies, and systematically develop data bases. The park will take an active recruitment role in seeking independently funded research on these topics. The park will provide housing and staff support when possible. In-house research projects will be completed within staff and budget constraints. The computerization of the data base, bibliography and geographically referenced materials will provide a retrievable and expandable source of information for future park managers and for visiting researchers.

All specimens will be accessioned, catalogued and stored per 36 CFR 2.5, NPS 28, and the Manual for Museums. Independent researchers, operating under contract or Collection Permit will be required to catalog specimens per NPS standards. Guidelines for this action will be developed by the park.

A Research Needs Plan will be developed and updated annually.

A Scope of Collections will be developed for the CRLA collection, identifying deficiencies and needs.

The enabling legislation of CRLA mandates protection of all "game and fish" and therefore falls under the regulations imposed by Title 36 CFR 2.5 (d) and (f). Research and collection that requires the killing of wildlife, fish, or plants will be denied unless it is demonstrated that the information gathered is identified in the Research Needs Plan. This does not apply to abiotic specimens. It is recognized that small collections of geologic specimens from Mt. Mazama are an important teaching tool at many universities and can lead to future reserch interest. Collection permits will be issued for such geologic specimens as long as they meet the general requirements of the Collection Permit. All specimens will be cataloged into the park collection per NPS 28.

All data collected will be permanently stored as archival records. A working copy will be retained in the Resource Management Office for reference. All originals will be stored in the park library or museum.

CRLA-N-2: Caldera Ecosystem Management

Statement of Issue:

This project outlines the need for management and protection of Crater Lake and the surrounding caldera formed by the collapse of Mt.Mazama over 6000 years ago. The Lake is the primary visitor attraction and is the primary resource of the park. At 1932 feet deep, it is the seventh deepest lake in the world and the deepest in the United States. It is noted for its extreme water clarity and its deep blue color. The lake has no surface outflows and only minor surface ground water inflows as springs along the caldera walls. The main source of water for the lake is precipitation, averaging 70 inches per year. Surface evaporation, leakage, and precipitation have formed an equilibrium that allows an average surface fluctuation of 3 feet per year. The recorded fluctuation (1961-1984, USGS) is 16 feet. Recent research has indicated that the lake may be very sensitive to changes in the influx of nutrients, resulting from natural or man-caused sources. The results of such changes are unknown and are presently the subject of study. Management of the caldera requires careful study and analysis of the possible influences of man's activities in and around the caldera coupled with an understanding of the lake ecosystem.

In 1982, PL 97-250 was passed by the U.S. Congress, requiring that:

> "...the Secretary of the Interior instigate studies and investigations as to the status and trends of change of water quality of Crater Lake and to implement such actions as may be necessary to assure the retention of the lake's natural pristine water quality.."

Because of the complexity of management of Crater Lake and the variety of issues, this section will be broken into the following categories:

Boat Use: The lake is generally protected from the secondary influences associated with boat use (petroleum products, litter, etc.) by the park's regulation of prohibiting private boats on the lake surface. (CFR 36. Part 7.2b). The park concessioner operates four gasoline engine tour boats from approximately July 1 to Sept 1 each year. The park operates three research boats on the lake. Fuel for the boats is stored in a 2000 gallon tank adjacent to Rim Drive and is located 1/4 mile west of the Cleetwood Cove parking area. The gas is gravity fed via PVC pipe to a 500 gallon tank located at the Cleetwood Cove boat dock. The pipeline is above-ground and can be seen from the trail. Boatdocks are provided at Cleetwood Cove and at Wizard Island in Governors Bay. Two boathouses and a generator house exist on Wizard Island and the serve the concessioner's boat operation. The park constructed a boathouse on the island in 1985 and stores the research boats for the winter

Visitor Use and Access: Access to the lake is limited to one trail, approximately 1.2 miles in length with a 12 percent average grade, at Cleetwood Cove. This trail is open approximately July 1 to Oct 15 as the visitors' only access to the lakeshore. The trail is also used by the NPS and concessioner's trail tractors to haul equipment to and from Cleetwood Cove. All other access to the lake is prevented by the steep caldera walls and climbing in the caldera is prohibited by park signing.

Visitors are limited to hiking the Cleetwood Trail to the lake as their only access route. At Cleetwood Cove, approximately 1/3 mile of shoreline is traversable. Wizard Island is accessible to the visitor via the daily tour boats. No overnight camping is permitted within the caldera or on the island. Some swimming occurs at Cleetwood Cove and at Wizard Island, but due to the water temperature, this is an infrequent activity. Fishing for the exotic stocked salmonids is an infrequent activity with only 27 fishermen recorded for 1984.

Waste Disposal: Visitors to Cleetwood cove are accommodated in a new (1984 installation) solar restroom. This facility composts the solids and evaporates the liquids and the composted material is hauled out via trail tractor. Prior to this installation, raw sewage was collected in two containerized "jet-Johns" and hauled out weekly via trail tractor. One containerized "jet-John" is located on Wizard Island. The raw sewage is hauled off the island once per summer. Prior to the installation of this containerized system in 1979, pit toilets were used at Cleetwood Cove and Wizard Island at the boat dock at Governor's Bay.

Fish: All fish found in Crater Lake are exotic. Stocking occured between 1888 and 1941 and primarily consisted of salmonoids. It is estimated there are low but stable populations of rainbow trout, kokanee, and brown trout. Accurate records of the stocking are available in park files. (See CRLA-N-16).

Structures and man related debris: The following structures are found within the caldera: (3) boathouses on Wizard Island (2 concessioner, 1 NPS), (1) generator buiding on Wizard Island (concessioner), (1) "jet-John" on Wizard Island (NPS), (1) solar restroom at Cleetwood Cove (NPS), (2) jet-johns at Cleetwood Cove (NPS), (1) 500 gallon gas tank at Cleetwood Cove (concessioner), (1) bulkhead and several floating docks at Cleetwood Cove (concessioner and NPS), and (1) USGS gauging station at Cleetwood Cove. There are two steel cables stretched across Fumarole Bay at Wizard Island. There are remains of past human activites within the caldera; e.g. boat wreckage, lumber, discarded supplies from the boathouse construction, pits from pit toilets, old access trails, and old lake level guages. Until the late 1960's it was a general practice to sink boats no longer needed or usable. There is an undetermined number of boats on the bottom of the lake.

Adjacent Human Activites: The caldera is ringed by thirty three mile long two lane paved road known as Rim Drive. This road is open from approximately July 1 until Oct 15 annually, and accommodates approximately 500,000 visitors. There are frequent "pull-outs" with associated self contained "restrooms". Rim Village, the principal

visitor use area, is open year-round and consists of a Visitor Center (VC), a picnic area, the Crater Lake Lodge, a cafeteria/gift shop, 12 cabins, a large parking area, restrooms, and several small administrative buildings. Sewage from the Lodge, VC, and Rim Center is transported via pipeline to the sewage lagoons at Munson Valley. Sewage from the parking area restroom, the cafeteria, and the cabins is piped to a solids holding system/liquids leach field at the rim at the top of Dutton Creek. The large 500 space asphalt parking lot at Rim Village drains into the caldera.

Limnology: Past research has focused on the optical properties, morphology, geology, fisheries, temperature gradients, and plankton distribution of the lake. Recent research raised questions about changes in the clarity of the lake water, indicating a 25% decrease in secchi disk transparency from an average of 38m in 1937 to an average of 36.6m in 1968-69 and an average of 29.3m in 1978-79 (Larson and Forbes). Park ONPS base and Significant Resource Problem (now NRPP) funding for research of the lake began in 1982. In the fall of 1984, a full-time Limnologist was hired to serve as the program Principal Investigator. The Lake research program is carried out on two reasearch boats, a 17 ft Boston Whaler and a Gregor Pontoon boat. The research program has been limited to summer research only due to the long winters and heavy snowfall. The construction of the boathouse in 1985 allows the addition of winter research in future years.

General: As the principal resource of the park, the primary visitor attraction, and the cause of the park designation by congress, the NPS has a very definite responsibility to manage Crater Lake in the spirit of preservation. Additionally, the park must allow some visitor enjoyment of the lake while minimizing impacts. The indications of loss of clarity as measured by the secchi disk readings has caused concern that the percieved loss of clarity is man-related. Further research is needed to better understand the overall lake ecosystem, to substantiate the loss of clarity, and if possible determine a cause. Simultaneously, the park must take every possible precaution to minimize the potential for man's activities affecting the caldera ecosystem.

Alternative Actions and Their Probable Impacts:

A. No Action (Current Action): Under this alternative the park would continue a two-part program of (1) implementing an intensive monitoring and research program on the lake ecosystem and (2) continuing to monitor and limit man's activities that influence the caldera ecosystem:

(1) Through base and special natural resource funding programs, the Crater Lake Principal Investigator (PI) develops an annual monitoring plan that outlines the parameters of lake data that will be collected. Park staff, using the lake research boats, collect the data and perform analysis in the park laboratory per Standard Methods and instruction of the PI. Special research programs may identified and funded per the approved monitoring plan. All data collected is loaded in the Oregon State University Cyber mainframe computer and is accessible to associated researchers upon formal request to the PI. The park maintains micro-computer capability (IBM PCXT), to access the OSU Cyber database with data transfer checking capabilities. The park continues to operate three

research boats on the lake during the sampling periods. The park continues to operate an in-house laboratory. The park and PI produce an annual lake research report and a biennial report to Congress on the quality of Crater Lake (required by PL 97-250).

(2). The park will continue to monitor human activites within and around the caldera. All development considerations will be thoroughly reviewed to consider potential impacts to the caldera ecosystem. Plans for the rehabilitation of Rim Village will be pursued with the intent of piping all sewage from Rim Village to the Munson Valley Lagoons per the 1985 Interim Development Concept Plan for Rim Village.

Impacts: This alternative adequately addresses the protection of the caldera ecosystem as required by law. Sensitive lake resources such as the clarity and water quality are being monitored through investigations into the nature of the lake system. A comprehensive ten year set of goals and objectives have been developed by the park and the PI which include studies of sedimentation, lake color, optical properties, paleolimnology and the development of a water and nutrient budget. This alternative adequately addresses the needs of visitors and the protection of the caldera from human activities.

Recommended Course of Action:

The recommended course of action is to continue with the actions outlined in Alternative A. The construction of a park boathouse in 1985 on Wizard Island allows the expansion of the lake research program to include winter sampling. The addition of winter data collected on a periodic basis each winter will allow greater interpretation of the overall data collected. The boathouse also has a space for a field laboratory for lake level filtration and analysis of some samples. Lake level storage of the research boats will also allow an extended fall season and an earlier start each spring. The Crater Lake Limnological Program is divided into three objectives:

Objective 1: "Long Term Monitoring" - Baseline data on physical, chemical, and biological lake features such as algae, zooplankton, benthos and fish.

Objective 2: "Lake Processes" - Food web, Sedimentation and Paleolimnology, and water and nutrient budgets.

Objective 3.: "Lake Changes" - Compare existing data sets with new information, Paleolimnology, Optics (color, properties).

Special investigations may be carried out to determine if sewage treatment activities at Rim Village are related to anomolously high nitrate values in the caldera springs. Sewage collection within the caldera will be limited to the minimum required and all human sewage will be containerized and hauled out of the caldera. The park will seek to develop a new method of collecting and treating the sewage collected at Wizard Island, with the possibility of a solar restroom. The park will limit all climbing within the caldera except at Cleetwood cove so as to minimize the introduction of human sewage.

No other alternatives were considered due to requirements of PL 97-250.

CRLA-N-3: Bear Management

Statement of Issue:

CRLA has a population of black bears (Ursus americanus) that has historically been involved in property damage in visitor use areas. Human/bear incidents at CRLA have not occured with any frequency in the past few years. Recorded bear incidents are as follows:

Year	Bear Incident	Personal injury	Bears Trapped	Bears Killed
1984	1	0	0	0
1983	0	0	1	1
1982	0	0	0	0
1981	1	0	0	0
1980	2	0	0	0
1979	32	0	2	1
1978	1	0	0	0

Historically, the park has had problems with black bears in the Mazama Campground and the Munson Valley residential area. A careful review of the records seems to indicate that the problems caused in 1979 were the result of several conditioned bears, which were eventually removed from the population. As a result of this and the implementation of the 1980 Bear Management Plan, bear incidents are rare at CRLA. The current population of black bears in CRLA is unknown. McCollum (1974) estimated the population to be 100-125 bears but this estimate is based on acreage of habitat rather than actual counts. Indications from adjacent land managers and wildlife observations are that the bear population is either stable or increasing. Over twenty bear observations were recorded for 1985.

Alternative Actions and Their Probable Impacts:

A. No Action (Current Action): The current action of the park is to implement the 1980 Bear Management plan (copy is attached in Appendix). This document involves the following:

1. The park visitor is informed of the regulations concerning the feeding of wildlife, especially bears, and of proper food storage.
2. Garbage cans are "bear-proofed" and refuse pickup is scheduled to reduce the amount left overnight.
3. Bears will be relocated when human/bear conflicts develop. The procedures for trapping and disposal of bears is detailed in the Bear Management Plan.
4. Bears will be relocated in the park unless an agreement is obtained from the Oregon Department of Fish and Wildlife and the U.S. Forest Service for release outside the park.
5. All bear activity and observations will be monitored and recorded.

Impacts: This alternative may have a negative impact on the bear population of the park by removing the problem bear(s) from the breeding group. The implementation of the Bear Management Plan will have a minor impact on the park visitor in the campground, requiring proper food storage and treatment. Occasionally, park visitors will be contacted by Park Rangers for failure to adhere to proper food storage procedures.

B. Alternative B - Discontinue park actions on bear management: Under this alternative, information would not be disseminated to the public in the campground and food storage and handling requirements would be eliminated. In the event of a bear incident, the bear would be trapped and relocated in the park. Repeat offenders would be eliminated from the population.

Impacts: This alternative would relax the requirement on the public for food storage, and thereby prevent interference with the visitor experience. Fewer Ranger/Visitor law enforcement encounters of this type would occur. The bear population would continue to be impacted by removal of problem bears. There may be an increase in incidents due to more available "human food" with the result of an increase in problem bears.

C. Alternative C - Seek Special Regulations for the park to require visitors to store food properly while in the campground: Under this alternative, Special Regulations for the CFR would be written and approved for enforcement of food storage offenders. All other actions are as current action.

Impacts: There would be an increase in the Ranger/Visitor Law Enforcement encounters concerning the food storage regulation. Some visitor experiences would be impacted. There may be a decrease in bear/human incidents due to more compliance in food storage requirements.

Recommended Course of Action:

It is recommended that the current action continue with an update of the Bear Management Plan every four years or as needed based on new findings. The park will continue to recommend to the visitor food storage and handling procedures to prevent bear incidents. Park staff will continue to work with the Oregon Department of Fish and Wildlife (ODFW) and the USFS to monitor bear incidents outside of the park and assist where feasible. Unless there is a substantial increase in the number of human/bear incidents, the park will not seek a new regulation on food storage.

CRLA-N-4: Livestock Trespass

Statement of Issue: There is no authorized livestock grazing within CRLA. Historically some trespass has occurred from animals grazing on USFS lands to the west and east of the park. Occasionally animals are found deep within the park near Annie Springs, the Pacific Crest Trail (PCT) and even in the caldera. These occurrences are rare. In 1980, PL 96-553 added 22,890 acres of USFS land to the park. These lands were previously grazed by domestic livestock, though with their addition to the park they are now removed from authorized grazing. The new west boundary is grazed by domestic cattle and the USFS lands on the east are grazed by domestic sheep.

No specific studies have been completed on vegetation impacts of grazing trespass within the park. Physical trampling and consumption of park vegetation has been noted by patrolling park staff. Impact on sensitive plant species found in the area is unknown. Cattle grazing is in competition with elk for forage in the area.

Grazing within the park is a clear violation of 36 CFR Part 2.60, Livestock Use and Agriculture.

Alternative Actions and Their Probable Impacts

A. No Action (Current Action): The current program is one of passive control of livestock trespass. Boundary patrols by park staff watch for cattle trespass. Any infringements are reported to the appropriate USFS ranger station which in turn contacts the grazing leasee. In most cases the leasee responds promptly to remove the trespassing livestock. Coordination between the park and the USFS is informal and based on a 1979, now expired, Interagency Agreement.

Impacts: This alternative identifies the problem only after the fact. Boundary patrols are infrequent due to short seasons and limited staff. Impacts on vegetation from trampling and consumption will continue in all areas around the boundary.

B. Alternative B - Increase patrols of boundary, enforce 36 CFR 2.60 on the permittee issuing citations for repeat trespass cattle on park lands: Negotiate new Interagency Agreement with the USFS for joint efforts in prevention of livestock trespass. Sensitive areas and livestock entrance areas will be jointly fenced.

Impacts: This alternative would provide better protection of the park vegetation by increasing the number of reported incidents. Enforcement of 36 CFR 2.6 on the permittee may cause poor neighbor relationships with locals and the USFS. Additionally, it may conflict with the state of Oregon's open range statute. Other Resource programs may suffer due to increased patrol time taking staff away from other projects. Fencing of specific areas is costly in installation and maintenance.

Recommended Course of Action: It is recommended that a combination of current actions and portions of Alternative B be implemented. A definitive Interagency Agreement for the eventual exclusion of livestock from the Park will be negotiated with the USFS. The agreement will contain a mutually agreed upon time frame for fence construction in key exclusion areas. Fencing projects will be jointly shared projects between the Park and the USFS. Surveys of sensitive plants will be conducted in critical areas. After fence installation, and all of the boundary is posted, livestock trespass will be treated as a violation of 36 CFR 2.60 and enforced accordingly. The fence will be typical of the cattel fences in the area and is expected to have no impact on the movements of local ungulates. Both elk and deer are quite capable of jumping cattle fences. Small species will pass easily through the fence.

CRLA-N-5: Rare and/or Endangered Species-Animals

Statement of Issue:

Crater Lake National Park has the affirmative responsibility to identify species of animals and their critical habitat within the park that are considered rare by state standards and/or threatened or endangered by the USF&WS, under the Endangered Species Act (ESA) of 1973 as amended. The following represents those animals known to occur within the Park, their current status and listing.

Species Common Name	Federal/State Status Status of species in CRLA
Falco peregrinus anatum peregrine falcon	Federally listed Endangered Species. Known nest site within Park.
Halacetus leucocephalus bald eagle	Federally listed Threatened Species known to use lake as feeding area. Historic nest site in caldera.
Odocoileus virginianus leucurus Columbia white-tailed deer	Federally listed Threatened Species. Last recorded sighting in 1977 (questionable validity).
Canis lupus gray wolf	Federally listed Endangered Species. Last recorded sighting in 1981.
Strix occidentalis northern spotted owl	Listed on Oregon Threatened Wildlife list. Known to occur within Park.
Gulo luscus Wolverine	Listed on Oregon Threatened Wildlife list. Last recorded sighting possibly 1984.

Other animal species known to have occured within the park and are considered rare but have no state or federal status are:

Picoides arcticus - black-backed three-toed woodpecker
Charina bottae - rubber boa
Lutra canadensis - river otter
Lynx canadensis - lynx
Accipiter gentilis - goshawk
Strix nebulosa - great grey owl
Asyndesmus lewis - Lewis woodpecker
Picoides tridactylus - northern three-toed woodpecker

Other animal species known to have occurred within the park and are considered rare but have no state or federal status are: (cont'd)

Sayornis nigricans - black phoebe
Salvelinus confuentus - Klamath bull trout
Taricha granulosa mazamae - Crater Lake newt
Rana pretiosa - spotted frog
Martes pennati - fisher

Alternative Actions and Their probable Impacts

A. No Action (Current Action): The Park's program for identification and protection of known rare species is best summarized by describing current actions on each species:

Peregrine falcons: Since the discovery of an active eyrie in 1979, the park has cooperated with the Oregon Department of Fish and Wildlife, the USF & WS and the Predatory Bird Research Group in Santa Cruz, California to observe the nesting behavior of this site. Due to nest failure in 1980, an annual action plan was developed and nest manipulations were begun. In 1981 and 1982 the eggs were removed and were replaced by live young which were reared by the parents. Due to the loss of parent birds in 1983, young peregrines were hacked out in 1983 and 1984. The 1985 program is explained in detail in the 1985 Peregrine Falcon Action Plan in the Appendices of this document. The eyrie and hack sites are restricted to employee only entry and administrative activities such as snowmobiling are prohibited during the breeding season.
Summary of Efforts to Date:

Year	Peregrines Placed in Eyerie (M/F)	Peregrines Hacked out (M/F)	Leg Band Number
1981	1 (F)*	0	987-55902
	1 (F)*	0	987-55903
1982	1 (F)*	0	987-55960
	1 (F)*	0	987-55961
1983	0	1 (F)	987-69576
		1 (M)	816-65004
		1 (M)	816-65005
1984	0	1 (M)	816-64333
		1 (M)	816-64335
		1 (M)	816-64334
1985	0	1 (F)	987-77264
		1 (M)	816-64348
		1 (M)	817-64349

* The peregrines placed in the eyrie were too young to accurately determine sex. They were banded with female leg bands, but may actually be males.

Bald eagle: No definitive survey has been conducted. Historic records show a nest within the caldera and sightings of mature and immature birds occur each year within the caldera. No attempts have been made to attempt to locate new nest sites. Observations of bald eagles within the caldera are relatively frequent.

Northern spotted owl: The first definitive call survey for spotted owls in the park was conducted in 1978. This was repeated in 1982 and 1983. On all occasions spotted owls were heard responding to the surveyor's calls. The principal areas of spotted owl habitat appear to be the old growth stands of fir on the west side drainages of the park. No nest site surveys have been conducted and nesting sites and pairs have not been located. Some discussions have occurred with the USFS on protection of spotted owls in Spotted Owl Management areas on adjacent forest lands. It is anticipated these call surveys will continue on a sporadic basis.

Other Species: The park takes no action on other rare animal species other than to record chance observations.

Impacts: The continuation of the peregrine falcon program will attempt to ensure the long term reproductive success of the falcon within the park and vicinity. Specific area closure during breeding season may interfere with some visitor activity. The passive approach to bald eagle management may allow some impact to occur to breeding pairs in the caldera due to concessioner and research boat operation. The spotted owl surveys have no environmental impacts. The passive approach to other rare species may, through lack of knowledge and subsequent action, cause impacts on those species' habitats.

B. Alternative B - Park would take a passive approach to management of all species: Under this alternative the park would take a more passive approach to management of all rare species within the park. The peregrine falcon would not be manipulated and would be allowed to succeed or fail on its own.

Impacts: This alternative is unacceptable due to its conflict with NPS policy and the mandate of the Endangered Species Act.

Recommended Course of Action: It is recommended that the current actions be continued with some minor additions. The peregrine falcon program will continue with an annual update of the action plan. Spotted owl surveys will continue on a periodic basis to identify critical habitats within the park. Emphasis on locating nest trees and pairs of birds will be increased based on funding. Once critical habitats are identified, some additional protection of those areas may be required. Bald eagle surveys will be conducted to determine their status within the Park.

Any nest sites that are located within the caldera will be evaluated for impact from visitior activities. An action plan will be drafted if necessary to protect the breeding areas. Cooperation with the State and adjoining land management agencies will be sought to determine the status of other rare animal species found in the region. The Park will continue the collection of chance wildlife observation recording of rare species.

The park will participate in any inter-agency wildlife surveys of species that are known to occur within the park and are conducted in the park area. The park will assist other land management agencies in developing management strategies for species that occur along the park boundaries. This is particularliy true of the northern spotted owl.

CRLA-N-6: Rare &/or Endangered Species - Plants

Crater Lake National Park has the affirmative responsibility to identify species of plants and their critical habitats within the Park that are considered rare by the USF & WS under the Endangered Species Act of 1973 as amended. There are currently no plant species found within CRLA that are listed by the USF&WS as threatened or endangered. The following list represents those plant species found within the Park considered rare and have status as State listed rare species, or are Federal candidate species. This list will require periodic updating. Those species that are under current consideration for listing by the USF & WS may be designated "Category 2" species, indicating there is insufficient biological information to determine their range and population status.

Common Name/Species	Family	Status/Remarks
Botrychium pumicola pumice grapefern	Ophioglossaceae	Category 2 Federal listing. Generally found on pumice gravel around 8,000 feet.
Collomia mazama Mt. Mazama collomia	Polemoniaceae	Category 2 Federal listing. Found along creeks along west side of Park.
Arabis suffrutescens var horizontalis Crater Lake rockcress	Brassicaceae (Cruciferae)	Category 2 Federal listing. Found on dry rocky pumice slopes of Cloud Cap, Garfield, and other peaks in Park.
Arnica viscosa sticky arnica	Asteraceae	Specimen in Park herbarium. Found in Park below the Watchman and Hillman area, and Union Peak.
Dicentra formosa ssp. oregana Pacific bleeding heart	Fumariaceae	Dicentra formosa occurs within Crater Lake NP but it it not known whether spp. oregana occurs in the population.

The above list represents those species found in the Park herbarium. A complete list of species that are considered rare by the State of Oregon and may occur within the Park is provided in the appendix.

Proposed Actions and Their Probable Impacts:

A. No Action (Current Action): The Park currently conducts an in-park survey of the population status of the pumice grapefern on an annual basis. Two statistical transect surveys are complete for the Llao rock population. No surveys have been completed for other species; other than those specimens collected during Elmer Applegate's (1939) collecting for the "Plants of Crater Lake National Park". Under this alternative, no additional surveys are planned. Under proposed construction projects, areas are surveyed for species prior to impact.

Impacts: The status of pumice grapefern will be known due to annual surveys and the area protected form impact. The status of the other species will remain unknown and are subject to potential impact from visitor use or park management.

B. Alternative B - Conduct surveys of the status of all rare plants in the Park: Establish critical habitats and protect as if designated as threatened or endangered.

Impacts: Surveys of this type are time consuming and costly and may draw energies from other CRLA projects. Once critical habitats are identified, treatment and protection as endangered/threatened species may create overly restrictive area use policies that are not warranted by the plant's official status. Restrictive use may interfere with visitor activities.

C. Alternative C: Discontinue program. No surveys will be conducted unless in preparation for development impacts.

Impacts: Noncompliance with Endangered Species Act. Status of plants would remain unknown.

Recommended Course of Action: The park will continue the annual survey of the population status of pumice grapefern. Through the CPSU's, local universities, and visiting researchers, the Park will encourage research into the status of those rare plants listed in the previous section of this document. Cooperative agreements with adjoining land management agencies will be sought to protect critical habitats that lie along mutual boundaries. Proposed "management areas" will be surveyed for rare plant species. Proposals for restrictive use will be reviewed individually for appropriate action based on current State and/or Federal status, population distribution and health, and proposed area use. Requests for collection of any plant considered rare in CRLA will be denied, unless for the purposes of permanent record not previously existing in the CRLA herbarium collection.

CRLA-N-7: Vegetation Management

Statement of Issue

Since the establishment of the park in 1902, human activities have altered the vegetation condition in some areas. These activities include but are not limited to: exclusion of fire, man-caused fires, road construction, trail construction, and facility construction. Those areas with vegetation changes as a result of fire exclusion or introduction will not be addressed in this project statement but rather in CRLA-N-10, Fire Management. The CRLA Hazard Tree Plan addressed in CRLA-N-9 requires removal of known safety hazard trees within visitor and administrative use areas. Due to the climate extremes, exotic plants are generally not considered a problem at CRLA. Verbascum thapsus, common mullein, an exotic from europe, has become common within the park along road shoulders and disturbed areas. This plant was not identified in the comprehensive vegetation survey by Applegate in the 1930's. Exotic plants are also covered in the Project Statement CRLA-N-15, Integrated Pest Management. There are some areas of former or current administrative use that require revegetation to reestablish a natural condition. They are:

Area	Status/Concern
Fire Roads:	Over 130 miles of former fire roads exist in the park. Under current policy, none are used for motor vehicle traffic.
Road Cuts:	All along the paved roads within the park are exposed banks of soil and rock. Rock sloughing has caused road bed damage and created safety hazards. Rapid reproduction of lodgepole pine on some road cuts will eventually create hazard trees and elimination of snow storage area during plowing.
Rim Village:	Extensive vegetation manipulation has historically occurred with much transplanting of native material. Heavy visitor use has caused much ground cover and shrub loss.
Borrow Pits:	There is an unknown number of borrow pits in the park used for road gravel paving and fill material. These areas have been left to revegetate.

Area	Status/Concern
Mazama Campground:	Intensive growing-season use by campers has eliminated much of the regeneration of the overstory in the campground. Increased stress to the trees will make them susceptible to Mt. Pine Beetle attack and loss of the overstory.
Backcountry Campsites:	Backcountry campsites are designated and localized vegetation impact occurs from repeated use. Current use levels are not causing increased impact.
Other Admin. Areas:	The primary administrative areas are in Munson Valley. An organic material dumpsite exists south of Steel Circle at the "Summer Dump". A small storage area is in the "pan-handle" called the "southyard". Vegetation here is manipulated to prevent hazards and blend aesthetically.
South Entrance Road Repavement Routes	There are 13 stretches of old south entrance road that parallel the new paved road that have not had the asphalt removed. There is a 6" layer of soil over the asphalt and lodgepole regeneration is occurring.
Proposed Development Areas:	Under the proposed Development Concept Plan, Rim Village will be revegetated to a more natural scene. Some previously unimpacted areas may be developed in other parts of the park. Erosion is generally not a problem in CRLA due to porosity of soils.

Proposed Actions and Their Probable Impacts:

A. No Action (Current Action): The current program is one of very passive surveys and vegetation manipulation. Under the CRLA Vegetation Management Plan, broad guidelines are set for identification of problem areas, development of action, and implementation of revegetation. (See Appendices) In broad terms, areas impacted by human causes are revegetated with native species in naturally occurring ratios. On small scale projects native seedlings or seeds are transplanted from the vicinity. On large scale projects, commercial sources of native plants are sought.

Impacts: Under the current program, areas are identified through the Vegetation Management Plan and funding sought for implementation. Native stock is retained and aesthetics are restored. The use of commercial sources of native seed may allow introduction of sub-species and varieties not naturally found in CRLA. In some cases, exotics may be introduced.

B. Alternative B - Allow disturbed areas to revegetate naturally.

Impacts: Under this alternative the aesthetics would be restored over the long term with short term loss of aesthetics. Native species varieties would be ensured.

Recommended Course of Action:

The recommended course of action is to continue the current actions with the following additions. All commercial purchases of native seed will be guaranteed pure live seed of known variety that is native to CRLA.

Action plans will be developed in accordance with the Vegetation Management Plan for specific areas as follows:

Area	Action
Fire Roads:	Identify those to be used as trails. Narrow pathway to trail size and allow natural regeneration along width. Allow natural regeneration on all other abandoned roads.
Road Cuts:	Hydroseed in priority order on biennial basis with commercially purchased native seed. Scale back steep rock walls where possible and where sloughing is a problem. Where there is a dense overstocking of lodgepole pine regeneration, thinning will be required.
Rim Village:	Analyze historic photos of the area to determine previous vegetation condition. Fencing, signing, and interpretation will be used to direct visitors and minimize impact.
Borrow Pits:	Survey and identify borrow pits. Use results to determine recontouring and re-vegetation needs.
Mazama Campground:	Survey areas for overstory regeneration. Rotate use, fertilize if necessary and isolate and protect areas/islands to ensure overstory replacement.
Backcountry Campsites:	Survey and record vegetation at designated sites once every 10 years, using a modified code-a-site analysis.
Other Admin. Areas:	Continue hazard tree program as is, identifying islands of protection for overstory replacement.

Area	Action
South Entrance Road Repavement Routes	Re-enter area and remove asphalt. Then allow natural reproduction.
Proposed Development Areas:	Restrict development to areas where vegetation will be minimally impacted and will adapt to use, such as areas of young forest. Revegetate areas where development is removed with native materials.

CRLA-N-8: Pumice Field Management

Statement of Issue:

Human activities, primarily illegal off-road vehicle use, intrudes annually into fragile pumice fields. Natural regeneration is very slow in these areas and evidence of human encroachment can be seen for many years.

The Pumice Desert, along the North Entrance Road, receives the highest visitor use and off-road vehicle (ORV) abuse of all park pumice fields. Each year new tire tracks can be seen leading from the road into the Pumice Desert. Other pumice fields receive such use but to a lesser degree.

Mueller's study in 1966 revealed that the relatively low density of plants on the Pumice desert (2580 plants/0.1 acre) and low rate of biomass production (0.2 grams/meter^2/day) was the result of species adapted to the harsh environment. Fourteen plant species were identified as adapted to the combination of fluctuating temperature, low relative humidity, high vapor pressure, and very low soil fertility. It should be noted that this study indicated that soil moisture was quite adequate and not a limiting factor. A list of the plant species is as follows:

Arabis playsperma
Arenaria pumicola
Aster shastensis var. eradiatus
Carex Breweri
Carex Halliana
Eriogogonum marifolium
Hulsea nana var. Larsenii
Lomatium Martindalei
Pinus contorta
Polygonum Newberryi
Sitanion Hystrix
Spraguea umbellata
Stipa californica
Viola venosa

Mueller also noted that impact from trampling in the "pullout" area had a significant impact on the vegetation abundance.

Evidence of intrusion onto the Pumice Desert and assorted pumice fields is raked out by hand. Tire tracks in one area were over 3/8 of a mile long and required two people one day to erase. This does not repair damage to plant life. Regeneration is slow due to short growing season and harsh conditions.

Alternative Actions and Their Probable Impacts:

A. No Action (Current Action): The current action is to rake over any disturbance to the pumice areas from ORV's. Patrols continue and vehicles found off the road are cited for violation of the 36 CFR 4.19.

Impacts: Under this alternative, the aesthetics are restored, though disturbance to the plant populations is not compensated. Raked areas take many years to revegetate. In some cases, raking may do more damage than the tire tracks, however, the presence of visible tracks may attract more ORV users.

B. Alternative B - Research plant population dynamics of pumice field and provide deterrent barriers to ORVS.

Impacts: Research will provide needed information for more productive rehabilitation efforts after subsequent ORV impacts. Barriers will provide better protection to fragile areas, though they may be considered unaesthetic.

C. Alternative C - Discontinue program.

Impacts: Vegetation damage will continue. Data will not be gathered.

Recommended course of action:

It is recommended that the dynamics of the pumice field vegetation be closely studied. CPSU and visiting researcher assistance will be sought. A barrier, constructed of peeled logs set on posts, set 15 inches above ground, will be installed along the Pumice Desert to deter ORV's. The low barrier will be constructed so as not to visually intrude on the aesthetics of the Pumic Desert but be of sufficient strength to deter ORV's. A separate Environmental Assessment will be prepared for this action. In the interim, all ORV tracks will continue to be hand raked.

CRLA-N-9: Hazard Tree Management

Statement of Issue: As a federal area open to the public, the NPS and CRLA have a responsibility to protect the visitor and their property from hazard trees. This was firmly established by the 1968 court case of Middough vs. U.S. when the court decided that the NPS had a duty to protect the visitor from obvious tree hazards. CRLA is a forested area and tree hazards are a potential threat to both public and federal property and health. There have been only a few minor reported incidents of tree failure and resulting damage within the park. The principal areas of concern are: Munson Valley, Mazama Campground, Lost Creek Campground, Rim Village, and the paved road and its associated pull-outs. The park has a responsibility to survey, identify, and remove hazard trees. The current program is based on the CRLA Hazard Tree Plan, approved in 1982, and based on the USFS Tree Failure Potential system. The defect location is based on "A Guide for Evaluating and Controlling Tree Hazards in the Pacific Northwest" by James S. Hadfield and Gregory M. Filip of the USFS. Tree Identification has not been a problem. Removal of the trees, once marked has been an operational difficulty.

Alternatives and Their Probable Impacts:

A. No Action (Current Action): CRLA is currently working under an approved Hazard Tree Action Plan (see Appendices) that covers the program in detail. Essentially, the USFS program of hazard tree rating has been adopted to evaluate trees for hazard potential. The principal concern areas are surveyed annually and trees are marked and identified for removal. Data is kept on the number, location, species, and action taken on each tree.

Impacts: Under this alternative, trees found to be potential hazards are removed from the visitor or administrative use areas. This results in a more rapid than natural removal of the overstory. It also eliminates some wildlife nesting trees. It does provide for a safer visit for the public, and protection for NPS property.

No other alternatives are considered as they would not comply with the requirements of the federal Tort Claims Act (1946) and the results of Middough vs. U.S. (1968)

Recommended Course of Action: It is recommended to continue the implementaion of the Hazard Tree Plan with a biennial update. Accurate records will be kept of all hazard tree actions. The park will seek funding to purchase a chipper to create mulch for addition of organic matter to administrative and visitor use areas. The chipper will chip trees removed as hazards. The park will work to place a higher priority on removal of trees identified as hazards and seek funding to contract or hire qualified fellers to remove those trees in difficult locations.

CRLA-N-10: Fire Management

Statement of Issue: Fires have been suppressed within CRLA since its establishment in 1902. This activity has altered the forest composition within certain areas of the Park, causing unnatural fuel loading, unnatural stand composition and densities, and possibly altering wildlife use of the area. For the purposes of the park fire management program, the Park can be broken down into the following forest types with differing fire histories. (As a cautionary note however, there is considerable overlap between these forest types and differences in the fire regime in those overlap areas. Research is on-going and incomplete for certain forest types.)

Forest Type	Natural Fire Regime/Impacts of Suppressson
Tsuga Mertensiana mountain hemlock	This upper elevation forest (5,500-8,000 feet) with associated white bark pine (Pinus albicaulis), has infrequent lightning-caused low intensity fires that are not stand replacing. Additional research is needed to determine the role of fire in this forest, but it seems that suppression since park establishment has had little effect.
Pinus contorta murrayana lodgepole pine	This forest type is found from 5,000 to 6,500 feet and is associated with Shasta red fir (Abies magnifica), noble fir (Abies procera), and mountain hemlock (Tsuga mertensiana). In the lodgepole dominant stands, fire frequencies appear to be approximately 1 fire every 60 years (Agee, 1981). Current research is investigating an association between fires and mountain pine beetle outbreaks within these areas. Fire suppression in the lodgepole forest since park establishment appears to have had little effect (Agee, 1981).
Pinus ponderosa ponderosa pine	This forest principally occurs on the south eastern edge, and northeastern corner of the park up to elevations of 5,500 feet. The ponderosa pine is commonly associated with white fir (Abies concolor), and in the lower elevations sugar pine (Pinus lambertiana) and some Douglas fir (Psuedotsuga menziesii). It is this forest type that has changed the most dramatically from fire suppression. A natural fire regime is one fire every 7-35 years in this forest type (McNeil, 1975).

ponderosa pine (cont'd)	The less fire resistant white fir, able to reproduce within the shade of the ponderosa pine has replaced ponderosa pine regeneration. The suppression of fire in the ponderosa pine forest has increased the fuel loadings, and thereby the eventual fire intensities. Should a fire occur under extreme conditions, it could have an unnatural stand replacing effect on the ponderosa pine. Reintroduction of prescribed fire into this forest type has resulted in the desired objective of killing the white fir reproduction. However, refinement of prescription parameters is needed to prevent overkill of the larger ponderosa pines.

The intent and policy of the National Park Service for natural areas (NPS Management Policies, page IV-13) is to allow natural processes to occur whenever possible and to reintroduce natural processes whenever necessary. Smoke management is covered in CRLA-N-11.

Alternative Actions and Their Probable Impacts:

A. No Action (Current Action): The current program for CRLA is directed by the Fire Management Plan. The plan was authored and approved in 1978 and is in need of updating. However, the basic premise of the plan will not change. The park is zoned into areas of suppression, conditional suppression and natural fire. These zones are based on forest type, topography, and adjacent land use outside of the park boundaries. Under this zoning concept, naturally occurring fires may be suppressed or allowed to burn depending upon the zone of occurrance and specific weather and fire behavior conditions. In all zones, fire may be reintroduced under a prescribed burning program.

The primary area of prescribed burning is the ponderosa pine forest. Prescribed fire will reintroduced into this forest for the purpose of re-establishing the natural conditions and equilibrium of the ponderosa/white fir system as it was prior to fire suppression. In forest lands that lie along the park boundary, it is recognized that natural fire will not resume its natural role due to the fact that fires originating on adjacent land will be suppressed by other land managers before reaching the park. Therefore, the park will always have to use prescribed fire to maintain "natural" conditions in those areas. In other forest types, naturally occurring fires are allowed to burn in specific zones without suppression activities.

Impacts: The current FMP inadequately addresses the specific needs of all fire management within the park. Continued implementation of this plan in its present form would not apply the findings of recent research nor apply current technologies to prescribed fire planning and implementation. The result would be a less than optimal natural fire program. The plan does not address the current requirement for smoke management applied by EPA and the state of Oregon.

B. Alternative B - Suppress all fires: Under this alternative, all fires within the park would be suppressed with available resources.

Impacts: The result of this alternative will be an unnatural forest with increasing fuel loadings and resulting catastrophic fires. Changes in the forest composition due to the exclusion of fire would eventually change the overall forest character and possibly the wildlife use of the area.

C. Alternative C - Update the FMP to current technologies and research: Under this alternative, the FMP would be updated to reflect current research and philosophies. The management of adjacent forest land would be considered in determining zones of suppression, natural fire, or containment. In some cases, the fire would be allowed to cross the administrative boundries between the park and the USFS lands. Current smoke management restrictions would be applied. Prescribed fire would be reintroduced on a periodic basis to the ponderosa pine forests. The time frame for periodic introduction of fire would be delineated by the Twenty-year Burn Plan. In natural fire zones, naturally occurring fires would be allowed to burn with periodic data collection and monitoring. Research into the fire effects and fire histories of the other forest types will be encouraged.

Fires that endanger life, property, or resource outside of the park through direct or indirect impact will be suppressed. Also fires that do not meet management objectives or are accidentally man-caused will be suppressed.

Impacts: Under this alternative a "natural" state of vegetation within the park will be maintained (as existed prior to the arrival of European man). The vegetation will represent an example of an undisturbed ecosystem for future study and comparison to areas outside the park. Smoke will be managed to meet State requirements. There may be some effect on visitor experience due to smoke along Park roads. Some complaints can be expected from Park neighbors.

Recommended Course of Action: It is recommended that Alternative C be implemented with the production of a new FMP in FY86. The new Fire Management Plan will address the zone concept of suppression, allowing fires to cross administrative boundaries with the USFS Wilderness areas with the new USFS "Contain, Confine, Control" policy, smoke management, air quality, and prescribed fire. The Twenty Year Burn Plan will be developed in FY86 to delineate the prescribed fire program for the coming years. Additional research will be encouraged in the areas of fire frequencies and histories in the lodgepole pine and mountain hemlock forests. Additional research and monitoring of fire effects of prescribed burning in the ponderosa pine forest will be sought. Such research will then be applied to the refinement of fire prescriptions.

CRLA-N-11: Air Quality

Statement of Issue:

It is the policy of the National Park Service to protect the quality of air resources in the National Park System by ensuring compliance with directives, regulations and applicable requirements of the Clean Air Act of 1970, as amended (P.L. 91-604, December 30, 1979; P.L. 95-95, August 7, 1977, 42 U.S.C. 7401 et seq.). The quality of air plays a vital role in visitor enjoyment, in the preservation of cultural resources, and in the perpetuation of natural systems. (National Park Service Management Policies, page IV-18).

The 1977 amendments to the Clean Air Act declared Crater Lake National Park to be a mandatory Class I area and charged the Federal Land Manager with an affirmative responsibility to protect air quality related values, including visibility.

To adequately discuss air quality at CRLA the topics of Air Quality Related Values (AQRV's), Potential Threats, Smoke Management and State & Federal Actions are discussed separately.

I. AQRV'S:

CRLA has identified the following as air quality related values with discussion of potential impacts:

1. View of Crater Lake from Rim Drive pullouts and Rim Village: Viewing the lake is the primary purpose of the CRLA visit, and this can be accomplished from 123 pullouts on the 33 mile Rim Drive open mid-June to mid-October. Rim Village is the only auto-accessible area to view the lake that is plowed in winter. The potential impacts to the visitor experience can be characterized by:
   a. Localized exhaust emissions from large concentrations of vehicles at Rim Village during summer months.
   b. Climatic conditions (rain, snow, fog)
   c. General reduction in air quality due to fine particulates that produce haze. This haze tends to reduce the intensity of the apparent blue color of the lake due to scattering of blue light (Pettit, 1935).
   d. Smoke in the caldera from in or outside park forest fires both natural and man-caused

2. View from Rim Drive outward from the park: A draft proposal of integral vistas was submitted in 1980 that included a 270° view from Watchman Lookout in the north to east to south quadrants, eliminating the southwestern 90°. These panoramas are of importance to the visitor as they provide an unparalleled view of the surrounding countryside. On clear days, Mt. Shasta can be seen to the south and the Three Sisters to the north. These views can be potentially impacted by fine particulates that reduce visibility.

3. Atmospheric deposition into Crater Lake: Recent studies indicate Crater Lake is nutrient deficient and therefore biologically limited (see CRLA-N-2). Recent studies also indicate the possible reduction in clarity maybe due to an increase in biological activity. As the lake has only minor ground water inflows, and no surface outflows, precipitation is the direct contributor as a water source. This precipitation could be providing nutrients in the form of nitrogen, with a subsequent significant effect on the lake clarity.

4. Vegetation: Two common trees found in CRLA are known to be sensitive to certain pollutants. Mountain hemlock (Tsuga mertensiana) is reported to be sensitive to SO_2 and ponderosa pine (Pinus ponderosa) is reported to be sensitive to ozone.

II. Potential Threats:

CRLA lies at the top of three river system drainages, the Umpqua to the northwest, the Rogue to the southwest and the Klamath to the south. Winds from valley warming occur on the valley floor and flow up the river drainages in summer, therefore, CRLA would receive some air pollutants from sources along those river drainages. The 1982 State of Oregon Air Quality Report reported these totals for emissions by river drainage:(Tons per year)

County	Drainage	CO	NO_x	SO_x	TSP	Org	Drainage Total
Douglas	Umpqua R.	75,067	9,471	986	15,689	11.094	112,307
Jackson	Rogue R.	82,996	7,089	904	16,449	11,715	
Josephine	Rogue R.	34,444	3,732	398	5,571	4,439	192,902
Curry	Rogue R.	18,257	1,293	117	2,751	2,737	
Klamath	Klamath R.	63,641	7,109	1,063	10,700	8,064	90,577

The Medford-Ashland area, which lies along the Rogue River drainage has been identified as a non-attainment area for the federal primary air quality standards for CO (carbon monoxide), ozone and TSP (total suspended particulates). The principal sources of these pollutants have been identified as automobile emissions, evaporated industrial emissions, and combustion (all types of burning including woodstoves). The possible impacts on CRLA from emissions in these areas have not been quantified.

Sources within the park include oil furnaces in maintenance, headquarters and the Rim Village concession facilities, seasonal campfires by visitors, oil furnaces and wood stoves in residential quarters, and auto emmissions.

Proposed geothermal development along the park's boundary has potential for emitting quantities of pollutants that may impact park AQRV's. (See CRLA N-13).

III. Smoke Management

The NPS and the State recognize that smoke from forest fires and forest management activities are significant contributors to visibility impairment. However, quantitative estimates of this impairment are not available at this time.

CRLA is involved in Fire Management activities as well as the neighboring U.S. Forest Service and State Department of Forestry. The park recognizes that some smoke is acceptable as it is a natural part of the ecosystem. Smoke levels become unacceptable when they impair visibility to such a degree that they detract from visitor enjoyment of the primary park resources, with primary emphasis on viewing the lake. Dense smoke within the caldera is generally unacceptable. Under the current fire management program, naturally occurring fires within CRLA are considered natural phenomena and will not be suppressed for smoke management concerns.

CRLA complies with the Oregon Smoke Management plan through an expired Cooperative Agreement, by completing the Form 1-1-3-400 and contacting the Oregon Department of Forestry prior to and during burning operations. This compliance is voluntary since CRLA lies outside of the restricted burning areas delineated by the State of Oregon (all areas west of the Cascades must comply).

IV. State of Oregon Requirements:

Under 40 CFR 51 300-307, the Environmental Protection Agency (EPA) has required the states to implement a program for protection of visibility in Class I areas and incorporate such programs into the State Implementation Plan. Due to several court cases, EPA has published proposed rules only for monitoring of visibility in Class I areas and review proceedures for new sources. Regulations concerning integral vistas will not be developed for several years. The State of Oregon has proposed rules for a statewide visibility monitoring program for Class I areas, in which CRLA participates.

V. Current CRLA Air Quality:

Data has been collected at CRLA since 1981 (discussed under the No Action Alternative) and indicates very good air quality in the park. The 1982-1984 Oregon DEQ report "Visibility in Oregon's Wilderness and National Park Lands" reports the standard visual range for CRLA to be 280 km (180 mi) for the 90th percentile. Also reported was a median visual range of 169 km (105 mi), with the least visual range towards the southwest (Medford). Nephleometer measurements at Rim Village indicate that the visibility is impaired only 4% of the time, however, this is based on only one summer's data (1985). The NPS fine particulate monitoring network quarterly reports indicate relatively low concentrations of visibility impairing fines such as fine sulfur (two year mean of 126 nanograms per m^3).

Alternative Actions and Their Probable Impacts:

A. No Action (Current Action): In cooperation with the state of Oregon, Department of Environmental Quality, and the NPS visibility monitoring network, CRLA monitors the following:

Fine Particulates (NPS program): A Series Filtration Sampler, SFS500, has been operated continuously since 1982 in Munson Valley as a part of the NPS Particulate Monitoring Network. A two stage filter captures particulates 15 microns or less in size. The data is analyzed by the NPS and quarterly summaries are provided to the Park.

Teleradiometer (State program): Teleradiometer measurements are taken 3 times daily from July 1 to September 30 from the Watchman lookout to 5 targets located outside of the park. These measurements began July 1, 1981. Annual summaries are provided to the Park.

Photodocumentation (State and NPS program): An OM-2 camera is used to photograph the teleradiometer targets at the same time teleradiometer measurements are taken. These slides can then be measured with a densitometer. Slides are stored at the park. An automated OM-2 camera was placed in the attic of the Rim Village Visitor Center in 1985. The camera takes three photos daily over the lake towards Mt. Thielson. In the winter the camera is moved to the attic of the Lodge for photography of the same scene. This is part of the NPS program.

Relative Humidity: Relative humidity and visual observation recordings are also kept to coincide with the teleradiometer and photodocumentation.

State Visibility Study: In 1984 a nephleometer was installed at Rim Village along with a wind speed and direction recorder and an ERT fine particulate monitor. These operated sporadically from July through September, with numerous electrical and quality control problems.

The no-action alternative would require the continuation of the monitoring activities above. CRLA would continue cooperating with the State in their visibility program and smoke management reporting.

Impacts: Data would continue to be gathered concerning reduction in visibiltiy in summer. CRLA would be meeting the basic requirements of the Clean Air Act of 1977, as amended. Problemns with logistics concerning the state equipment would continue. Data gathered by the fine particulate monitor in Munson Valley may not be representative of the park due to Munson Valley developments. No data will be collected on winter visibility.

B. Alternative B - Discontinue monitoring: This alternative will not be considered due to the requirements of the Clean Air Act of 1977.

Recommended Course of Action: It is recommended that all of the above monitoring activities be continued with the addition of the following:

1. Install automated teleradiometer and camera in Rim village area to record measurements across the caldera to an outside target. This will provide year-round documentation of the CRLA visibility over the primary resource.
2. Establish a site at Rim village for installation of air quality equipment including the State visibility program instrumentation.
3. Move fine particulate sampler from Munson valley to Rim Village with other AQ equipment.

4. Initiate periodic atmospheric deposition analysis for relation to Crater Lake water quality studies.

5. Continue participation in State rulemaking regarding integral vistas, new source reviews and other visibility regulations.

6. Request quantitative analysis and study of CRLA AQRV's.

7. Hire part time staffer to handle all aspects of equipment maintenance and quality control.

8. Negotiate a new agreement with the Oregon Department of Forestry for recognition of the CRLA fire management program priorities and protection of the park's Class 1 values.

9. All data collected will be archived and incorporated into the park's museum. This includes the slides taken for visibility.

Under this alternative, the park would initiate an AQ program that would lead to a more quantitative analysis of the AQRV's and related impacts. Coopertion with the State would be maintained and all agencies would be better served. Data would be gathered year-round from an area more representative of the park in general.

CRLA-N-12: Elk Management and Study

Statement of Issue: Even though historical records indicate that Roosevelt elk (Cervus elaphus roosevelti) were once abundant in the area around the Park and undoubtably used the Park on a seasonal basis, it is difficult to determine what species was present primevally. White settlers hunted these animals extensively and reports indicate the Roosevelt elk was practically extripated by 1890. In 1917, 15 Rocky Mountain elk (C. canadensis nelsoni) were transplanted from Yellowstone and released in or near CRLA (Ebert,1973). These two subspecies readily interbreed and the elk found in CRLA today may be a cross between the two types.

Three reports have been completed on the elk within CRLA: one in 1973 by McCollum, one in 1974 by Manning and one in 1975 by Hill. Population estimates ranged from 100 to 150 animals. The highest density is found in the southwest corner of the Park near Union Peak, with smaller groups in all other Park sections.

Elk use of the park is seasonal. Elk enter the park approximately at the time of snow melt and may cross large snow covered areas to reach the open southern exposures. The elk over-winter in lower elevation, State, private, and U.S. Forest Service lands. During that period they are subject to a regulated State hunting season and off-season poaching. They are currently protected from hunting within the park.

Very little quantitative information has been collected within CRLA and on adjacent lands about the biology of these elk. The park does not know if the herds are increasing or decreasing, and what areas within the park are preferred and why. Such information is important for management decisions concerning backcountry use, vegetation inventories, and cooperative wildlife management strategies with neighboring land management agencies and the State Department of Fish and Wildlife. Additionally, the Klamath Indian Tribe has won several recent court decisions concerning their treaty rights to manage wildlife populations on aboriginal lands. This includes the east side of CRLA. For sound elk management decisions, more biological information is needed on the CRLA herds.

Pellet plot counts were begun in 1975 in the Union Peak and Crater Peak areas for a total of 23 transects. Associated with the pellet transects are vegetation plots that characterize the forage in the elk use areas. The pellet counts have been completed sporadically from 1975 through 1983. There are numerous problems with this technique and at best it can only be used as a relative measure of the population trends. An analysis of the data in 1984 indicates too much disparity in the data to indicate a trend in population density.

A recent court case involving the Klamath Indians and the State of Oregon concerned the aboriginal rights of the Klamaths to hunt, trap and fish

without regard to State of Oregon hunting regulations on original treaty lands. A portion of these treaty lands are within the current CRLA boundaries. Should this decision have granted those rights to the Klamaths, the eastern one-half of CRLA would have been open to hunting by the tribe. A decision record by the Supreme Court of the U.S. in 1985 was granted in favor of the State of Oregon. This individual case has passed, however, the issue of native rights for hunting is not a closed issue in and around CRLA. Research on the population dynamics of the elk herd is necessary to understand impacts of hunting, poaching and furture pressures on the herd.

Alternative Actions and Their Probable Impacts

A. No Action (Current Action): Under this alternative the pellet plot counts would be continued on annual basis. Cooperative efforts with the Oregon Department of Fish and Wildlife would be continued to determine population density and biological health of the elk. No new comprehensive studies would be initiated.

Impacts: Due to inherent problems with the pellet plot count method of surveys, data on population trends is subject to question and very limited in its interpretation and application. Actual information on the biological charcteristics and seasonal movements would not be collected. Impacts on the herd from hunting and poaching as well as potential effects on park vegetation from an increasing (or decreasing) herd would be unknown.

B. Alternative B - Discontinue all research.and monitoring: Under this alternative no research would be conducted. Only that information gathered by adjacent land management agencies regarding the elk would be collected.

Impacts: As in alternative A, this alternative would not provide the information necessary for management decisions.

C. Alternative C - Initiate elk research program: Under this alternative, an intensive elk research program would be initiated. The research program would consist of a telemetry study over several years to determine seasonal movements and population biology of the elk herds using the park.

Impacts: This alternative would provide the necessary information for management decision regarding the elk population. Some elk fatalities may occur during the tagging and telemetry work.

Recommended Course of Action: It is recommended that Alternative C be implemented. This alternative recommends a more substantive research program over several years to determine the following information:

1) Productivity of herd in terms of annual cow-calf ratio
2) Seasonal movement dates including routes, dates and over-winter areas
3) Principal park use areas based on time
4) Vegetation character of elk use areas within park
5) Population trends

This information will be gathered in cooperation with the Oregon Department of Fish and Wildlife, the Klamath Tribe, and the U.S. Forest Service. Study design will be accomplished through the Cooperative Park Studies Unit at Oregon State University. The study is expected to begin in 1985 with the radio collaring of elk in the southwestern boundary portion of the park and USFS lands. Telemetry tracking for a subsequent 1 to 2 years will yield the necessary information. The pellet plot count will be discontinued until the results of the telemetry study can better define the data collection techniques.

As the elk are seasonal occupants of CRLA, some tracking and telemetry work will take place outside of the park boundaries. The need for this information is important in determining the migratory routes and the overall feeding and breeding cycle of the elk. This information will be of invaluable assistance to the adjacent land managers in developing their wildlife policies.

This study id part of the PNR NRPP Multipark Elk Study program.

CRLA-N-13: External Influences

Statement of Issue: At 182,700 acres, CRLA cannot be considered an island in biological terms. Wildlife populations migrate in and out of the Park, to and from lands with differing protection regulations. Air masses from distant areas carry air pollutants to and through the Park. Visitors driving along Rim Drive experience views of the Cascades that extend as much as 150 miles beyond the Park boundaries. Downstream activities can potentially affect upstream fish migrations, and boundary activities can affect park resources.

All of the lands adjacent to CRLA are owned by the U.S. Forest Service except for a small section on the Southeast corner which is state land. Under the USFS administration, the lands are open for multiple use including recreation (hiking, camping, snowmobiling, hunting, etc.), timber management, firewood cutting, energy development (hydro and/or geothermal) and mineral extraction.

Those activities that occur outside of the Park with potential impact on Park resources can be generally described as follows. This list is not intended to be all inclusive as new influences may develop that were unanticipated.(See also Air Quality CRLA-N-11, Livestock Trespass, CRLA-N-4).

Timber Management: The clearcutting or partial cutting of timber outside of the Park boundary is generally considered as no threat to Park resources, as long as these activities are carried out with regard to applicable laws. Standard USFS and State timber operations are only barely visible to the Park visitor and only rarely audible in the visitor use area at Pinnacles. Some concern exists over aerial application of herbicides that may drift from timber management areas adjacent to the Park boundary. Timber removal adjacent to the Park boundary is not considered a threat to park resources as long as some wildlife travel corridors are maintained, and no timber theft occurs within Park boundaries. The opening of public access roads adjacent to Park boundaries has increased the illegal removal of Park trees by firewood cutters and eased access for wildlife poaching. Timber operations such as partial cutting and clearcutting may have potential impact on migratory and resident elk, deer, bear, and spotted owl populations within the park.

Hydroelectric Development: In recent years there have been an increase in requests for water diversions of streams originating within CRLA and flowing through USFS lands, for the production of small scale electricity. These have potential impacts on any upstream fish migrations to the Park.

Geothermal Development: The Cascades, particularly the area adjacent to CRLA has been recently identified as having high potential for geothermal powered electricity production. Geothermal exploration lease applications exist for the east, south, north and northwest areas of USFS lands adjacent to CRLA. Exploratory drilling to 4000 ft. on up to 24 sites is planned for the summer of 1986 on the east side of the park. Many of the proposed drill sites are within one-quarter of a mile of the park boundary. Test wells are planned at an elevation of 4500, and with drill depths to 4000 feet, this will be well below the bottom of Crater Lake. Based on findings from the exploration, production test wells to 10,000 ft. and/or facility development may be proposed in the near future. BLM administers the subsurface resources of the USFS lands. Potential impacts from this development include but are not limited to:

1) Impact/effect on the subsurface hydrothermal system below Crater Lake.
2) Degradation of CRLA's Class I air quality from point source emmissions characteristic of geothermal steam.
3) Noise from drilling operation and steam generators heard at Pinnacles and the panhandle visitor use areas.
4) Water pollution in and water extraction from streams that have migratory fish populations.
5) Impact/disturbance on migratory and calving elk.
6) Reduction in visitor experience from stream plumes within the integral vistas from park overlooks.
7) Interruption of peregrine falcon feeding routes from the Park to the Klamath Forest Refuge.

Mineral Extraction: Rock quarries exist within the USFS lands and some are currently visible from the park. Due to their current distance and relatively small size current activities associated with these operations are not considered a threat to park visitor experience, or park resources.

External Recreation Use: Through coordination with adjacent land managers, the Park encourages recreational use of adjacent lands, particularly activites that are incompatible with CRLA and NPS policies and regulations (eg. snowmobiles on nondesignated routes, ORV's, and mountain bikes on trails). Recreational use of this type on adjacent land has no impact on park resources. The Park continues to work with adjacent land managers to inform recreationalists of the differing regulations on NPS lands and to ensure there is no illegal entry of those activities into the park.

Aerial Overflights: Frequent violations of air space over the park occur, particularly in the summer. Commercial and private airplanes and helicopters have been observed within the caldera at low altitudes. Military aircraft have also been observed within the caldera. These activities are not only dangerous, but also detract from the visitor experience and have potential for disturbance to sensitive wildlife (eg. peregrines, bald eagles, etc.)

Alternative Actions and Their Probable Impacts:

A. No Action (Current Action): The Park's current actions in regard to external influences can be considered passive monitoring and cooperation with adjacent land managers. No monitoring of park resources related to external impacts is occurring. The Park staff continues to review new proposals for external influences.

By category, the Park actions include:

1. Timber Management: Park staff reviews USFS timber sales on adjacent lands. On particularly large sales, the park may participate in the environmental analysis process. The Park provides comments in the form of technical assistance (per NPS-12) on USFS land management plans that detail herbicide use.
2. Hydroelectric Developement: Park staff comments on potential impacts to aquatic resources to the appropriate agencies.
3. Geothermal Development: Park staff has participated in the environmental analysis procedures for the phase II operations of exploratory drilling. A monitoring plan was developed for the Environmental Assessment.
4. Mineral Extraction: Park staff comments on proposed extraction operations.
5. External Recreation Use: Park staff patrols the boundaries and enforces the 36 CFR on violators.
6. Aerial Overflights: The park staff attempts to identify violating aircraft by copying aircraft identification numbers. Those noted are reported to the FAA and other appropriate agencies.

Impacts: Under a continuation of the current actions, most impacts from external sources would be identified and mitigated through channels of formal and informal communication with neighboring land managers. New sources of impacts may be identified early enough to initiate action. Park resources would not be monitored so a true measure of impact may not be developed. Impacts on varied Park resources from the geothermal development will go unrecorded.

B. Alternative B - Expand monitoring related to geothermal development: Continue all actions as in Alternative A with an expansion of monitoring of those resources related to potential impact from the geothermal development. This would include:

1. Quantitative analysis of the extent of the hydrothermal system under Crater Lake.
2. Specific site monitoring for impacts from geothermal steam emmissions.
3. Monitoring of noise from geothermal operations at primary CRLA visitor use areas.
4. Study of migratory wildlife impact.
5. Telemetry study of peregrine falcon feeding areas from park area.
6. Sociological study of visitor experience impacts from geothermal steam plumes.

Impacts: Under this alternative date would be gathered on quantitative impacts to park resources from geothermal activities.

C. Alternative C - Discontinue all monitoring of external activities as they relate to park resources: Do not review adjacent land management proposals.

Impacts: Potential and realized impacts to parly resources and the visitor experience may occur without NPS comment or imput. Park resources could be degraded in direct violation of existing laws.

Recommended Course of Action: It is recommended that Alternative B be implemented. This will ensure the identification of all external influences on park actions and allow appropriate action to occur in a timely manner. The data gathered in regard to the geothermal exploration and development will assist the park in determining the extent of the potential impact from such development on Park resources. The park will also continue to participate in the environmental assessment process evaluating the phases of the geothermal exploration and development. Assistance will be sought from NPS staff geologists to review down hole information gathered by the geothermal development corporation(s) for information as to potential impact on Crater Lake itself. The CRLA staff will participate in on-site reviews of the drilling operations and in monitoring of impacts to local resources. More cooperative efforts will be sought with adjacent land managers in determining potential impacts to wildlife from activities on adjacent lands. Where possible, joint studies will be conducted.

Special funding, such as NRPP, will be required to monitor the impacts from Geothermal development.

CRLA-N-14: Park Management and Visitor Use

Statement of Issue:
CRLA receives approximately 500,000 visitors per year, primarily between June and September. Use is concentrated in the Rim Villege area and along Rim Drive. Backcountry use is minimal and this is principally along the Pacific Crest Trail. Backcountry users are required to complete a backcountry permit

Visitation Figures 1981-1984

Year	Campground	Backcountry	Total
1981	46,359	2,618	536,719
1982	35,706	1,723	484,283
1983	11,829	2,055	429,586
1984	12,162	1,640	499,945

There are impacts to Park resources from visitor use and also from the administration of the park. These impacts are generally related to vegetation trampling, vegetation removal, ditching, hazard tree creation, human waste and animal waste. Some are the result of past uses, some from current use and some anticipated from future use/and development. The following list indicates those areas of concern that will require development of management strategies. A brief description of perceived impacts is included:

1. Concentrations of Visitor Use: Rim Village, due to design, concentrates visitor use into a small area. Auto emmissions concentrate to form a reduction in local air quality. Snow removal from the parking area into the caldera possibly causes petroleum products to reach the lake. Sewage treatment for Rim Village currently uses a leach field system for the cafeteria and the parking area restroom. This system could be the cause of unusually high nitrate levels found in the springs below Rim Village. Concentrations of visitors at popular pullouts along Rim Drive and the entrance roads causes vegetation trampling.

2. Backcountry Camping: Current use levels are such that designated sites are recommended. A Backcountry Management Plan is in draft and will be completed in 1985. There is some potential for impact to sensitive resources such as Sphagnum Bog from adjacent camping (wastewater and human sewage).

3. Recreational Activities: Crosscountry skiing and snowmobiling are recognized activities at CRLA. Snowmobiling is only authorized from North Entrance to North Junction on the existing paved road (36 CFR 7.2). Snowmobiling is not authorized on other paved roads due to conflict with skiers, safety considerations from avalanches, and seasonal disturbance to peregrine falcons.

4. Munson Valley Administrative Area: The location of the administrative area within Munson Valley allows petroleum products from the maintenance facility to enter and potentially impact Munson Creek. Gasoline, oil and grease from auto, truck and heavy equipment maintenance and use contribute the petroleum products. Sewage treatment for Munson Valley and one-half of Rim Village is a lagoon system in Munson Valley.

5. Campgrounds: Two campgrounds, Mazama and Lost Creek, serve the visitor. Continuous use during the growing season has caused substantial overstory loss. Continued stress on this primarily lodgepole pine forest will probably result in a mountain pine beetle infestation.

5. Potential Development: The 1977 GMP and the 1984 CRLA Development Concept Plan call for major changes to the visitor service facilities at Mazama, Munson Valley and Rim Village. All proposals include development in previously unimpacted areas. All current and new proposals must be evaluated to minimize impact on Park resources. Removal of existing development will require revegetation and restoration of natural contours. All proposals for new visitor or administrative activities and new or redeveloped visitor or administratrive areas have potential for impact on Park resources.

6. Stock use by hikers: Packstock are permitted on the Pacific Crest Trail within the Park. Current use is low with less than 15 parties per year. The primary problem associated with packstock in the Park is the scarcity of water in the backcountry. The backcountry users near Red Cone Spring must share potable water with the packstock, creating a potential for contamination.

All current visitor activities must occasionally be reviewed for impact on Park resources such as water quality, wildlife, and vegetation.

Alternatives and Their Probable Impacts

A. No Action (Current Action): The current actions are to participate in planning of all proposed changes to visitor and administrative facilities. All proposals are evaluated for NEPA compliance and impacts on park resources. Current visitor activities are monitored and controlled with existing regulations and signing. In some cases visitor movement may be restricted with low profile barriers. Backcountry impacts are monitored in accordance with the Backcountry Management Plan on a periodic cycle with a modified Code-A-Site. Vegetation impacts are corrected with revegetation or exclusion when identified. Visitor use statistics are collected according to the Monthly Public Use and backcountry use reporting requirements.

Impacts: Under this alternative most impacts to resources are anticipated in advance and mitigated as much as possible. Specific visitor use patterns will not be available for management decisions and interpretation of visitor impacts to resources.

B. Alternative B - Initiate and support Sociological research projects: Projects on the visitor and the employee of the park will be developed to assist in tailoring visitor and administrative activities to better protect park resources. In areas of proposed development that have no

previous impact, complete pre- and post development vegetation and/or wildlife surveys to determine impacts.

Impacts: Visitor and administrative use will be better understood and management may modify plans accordingly. The resources will be better protected.

Recommended Course of Action: It is recommended to combine both Alternative A and B. Sociological research will be initiated to better understand visitor use. New proposals will be evaluated for potential resource damage. The Backcountry Management Plan will be completed and implemented. Periodic water tests of springs close to packstock use will be completed during summer.

CRLA-N-15: Integrated Pest Management

Statement of Issue:

Pest problems at CRLA are not common but those that are identified are treated according to the principles of Integrated Pest Management. Those problems that have been identified are as follows with a brief description of impacts:

1. Mountain Pine Beetles (MPB): Several large infestations of MPB have been identified primarily in lodgepole pine forests on the eastern side of the Park. These infestations are considered a natural occurance and no control actions are anticipated. The park receives survey information from the USFS annual pest management aerial surveys.

2. Rodents and Plague: Klamath County is a recognized high risk area for the plague with several deaths attributed in the last 5 years. Plague is carried by fleas found primarily on rodents (ground squirrels, etc.). There is no current evidence that the plague vector exists within CRLA, however there is a large concentration of golden mantled ground squirrels at Rim Village. This population is unnaturally dense and thought to be artificially supported through feeding by park visitors. The golden mantled ground squirrels are aggressive feeders and beg food from the visitors. Physical contact between the ground squirrels and visitors is common. A study of the signing used to deter visitors from feeding ground squirrels was completed in the summer of 1983 (Swartzkopf).

3. Structural Pests: There are a number of structural pests found in, underneath and around the quarters, administrative and visitor structures in Munson Valley and Rim Village. They can generally be grouped as follows:

A. Insects: Powder post beetles have been noted in Steele Circle quarters. Carpenter ants continue to be an aesthetic problem in Steele Circle. Carpenter ants in building 129 have been mining the walls.

B. Rodents: Bushy-tailed wood rats often enter the Headquarters and some of the Stone Houses. Predators such as martens, often pursue the wood rats into the quarters. Their impact is usually in the form of noise disturbance and offensive odors to occupants. Ground squirrels are common in the lodge and pose a health hazard when found in the food preparation areas.

4. Exotic Plants: Exotic plants are generally not considered a problem at CRLA since extreme weather conditions preclude most exotic plant invasion, even in disturbed areas. Mullein (Verbascum thapsus) and others occur along the roadsides, particularly on the south entrance road, along with less common roadside weeds. Some exotic plant encroachment has undoubtably occurred on the lands added to the park in

1980, as they were previously grazed by livestock. With planned construction projects during the implementation of the CRLA Development Concept Plan in the next five years, there will be increasing opportunity for exotic plant encroachment.

Alternatives and their Probable Impacts:

A. No Action (Current Action): Under the current program, pest problems are identified by employees, visitors, residents or the concessioner. RM staff investigates the perceived problem and develops an IPM summary plan for solutions. In most cases, the use of pesticides will not be recommended. Signing is used at Rim Village to inform visitors of the regulations concerning animal feeding. The ground squirrel population at Rim Village is monitored for plague infection by watching for a die-off. Structures in the planning process for renovation are recommended for pest control features to exclude rodents and prevent other types of deterioration. MPB surveys by the USFS are continued and information shared with the Park. Quarters residents may use over-the-counter pesticides within their own residences. Rodents in administrative or visitor facilities are either live or kill trapped and removed from the structures.

Impacts: Under the current program, most problems with pests are solved with a minimum impact on resources. Live trapping of rodents in structures results in the removing of individuals from local populations and transportation to other parts of the park. Kill trapping results in removal of some individuals. This is a relatively infrequent activity and the impacts are considered negligible. Using the IPM Action Plan technique to each identified problem results in the best technique for control under NPS policy and regulations. Restrictive use of pesticides prevents any contamination of waters or non target species. The use of regulatory signs at Rim Village to control feeding of ground squirrels has been relatively ineffective; the squirrel population remains dense and the potential for plague remains high.

B. Alternative B - Utilize pesticides: Use pesticides in structures on a routine basis to control both insect and vertebrate pests. Provide periodic flea surveys to determine if plague vector is in ground squirrel population. Utilize pesticide dusting tunnels at Rim Village to control flea popluation.

Impacts: Under this alternative, better control would be achieved though some nontarget species may be impacted. Local populations of rodents may be eliminated. There is potential for water contamination from improper pesticide use. Greater assurance against plague incidence would be provided.

Recommended Course of Action: The recommended course of action is to continue the current action with the following modifications:

1) Conduct a contracted survey of all structural pest problems in park facilities and request funding for corrective, exclusionary actions. Buildings planned for renovation will be modified per pest control requirements.

2) Use a combination of regulations and plague warning signs at Rim Village to discourage visitors from feeding and making physical contact with the ground squirrels. Use plague information posters on selected bulletin boards to insure visitors are aware of the potential.

3) Work with the concessioner to require compliance in excluding ground squirrels from the eating and food preparation areas of the lodge.

4) The encroachment of exotic plant such as common mullein will be closely monitoried. Mullein and otehr large and obvious exotics will be pulled up and disposed of through the park garbage service. Attempts will be made to pull the plants before the seed head matures. In large areas of disturbance, IPM programs may be requires to prevent or control exotics.

5) In areas where carpenter ants are determined to cause structural damage to park or concessioner facilites, approval may be sought for use of approved pesticides.

CRLA-N-16: Aquatics and Fisheries

Statement of Issue: This project statement is intended to cover those issues related to surface waters within CRLA other than the lake and to the fish, both native and exotic, that occur within those waters and the lake itself. The issues here overlap with those in CRLA-N-2, Caldera Ecosystem Management and CRLA-N-14, Park Management and Visitor Use and Livestock Trespass CRLA-N-4. There are surface water resources found within the park that deserve protection. The following is a brief description of each, their specific resources, and potential problems.

Sphagnum Bog: This area is a large peatland near the western park boundary, and was the object of a study by Susan C. Seyer in 1980. It is noted for vegetation not previously ecologically investigated in the Pacific Northwest. There is some evidence of impact from livestock trespass. Due to its remoteness, it receives little visitor use.

Thousand Springs: This area is a large congregation of springs erupting near the south-western boundary of the Park. It is accessible by U.S. Forest Service roads and receives a moderate amount of visitor use and some livestock trespass.

Other Springs: Lightning Spring has a backcountry campsite near the head of the spring and receives moderate overnight use. Day hiking to the area is popular. The area is too deep in the park to receive impacts from livestock trespass. Boundary Springs is a popular day use area and is the origin of the Rogue River. It is a popular day hike destination. Cascade Spring and Anderson Spring are too remote to receive much use. There is some conflict of use at Red Cone Spring between stock use and backpacker use on the Pacific Crest Trail.

Park Streams: There are streams within the park that originate as springs and flow out of the park. Most are located in deep ash canyons and are relatively inaccessible. Some support small native fish populations of Dolly Varden trout, and introduced species of other salmonids. They can be listed as follows by major river basin:

Klamath Basin (Klamath River):

Annie Creek: Originates as Annie Spring, which is the park potable water source. Mazama Campground lies above Annie Creek Canyon and a trail leads to the stream edge. This trail is very popular in the summer. Major tributaries are the East and Middle forks, Goodbye Creek, Pole Bridge Creek and Munson Creek. Munson Creek drains Munson Valley and most of Rim Village. Munson Springs was the park potable water source prior to 1975 and was the subject of sewage contamination in that year. Munson Creek receives run-off from the Munson Valley adminstrative, visitor, and residential activities. A sewage lagoon system for all of these facilities exists in Munson Valley. There is potential for contamination of Munson Creek from petroleum products from Munson Valley.

Sun Creek: The only tributary on this stream is Vidae Creek originating at Vidae Falls. Sun Creek flows between Vidae Ridge and Grayback ridge and is relatively inaccessible except at the headwaters. Near the headwaters is the Vidae Falls picnic area and the Kerr Notch overlook.

Sand Creek: This stream is in the valley between Grayback Ridge and Anderson Bluffs with tributaries of Wheeler Creek, Lost Creek, and Cavern Creek. Sand Creek is paralleled by the Pinnacles Road' but lies in a deep ash canyon and is inaccessable. Lost Creek Campground and an associated water system and sewage treatment system lie along Lost Creek. The campground has 12 sites and recieves moderate use in summer.

Bear Creek: Originates as Cascade spring and is relatively remote and inaccessible.

Rogue River Basin (Rogue River):

Castle Creek: With tributaries of Little Castle Creek, Trapper Creek, Whitehorse Creek, and Dutton Creek, this stream is the largest drainage to the west of the park. The stream lies at the bottom of an ash canyon and is accessible via Whitehorse Creek to Llao's Hallway. This area is infrequently visited by day users. The upper portion of Castle Creek may have some contamination from the sewage leach fields that serve a portion of Rim Village.

Copeland and Bybee Creeks: The head waters of these creeks are passed by the Pacific Crest Trail. Otherwise they are free of impact.

Crater Creek: This stream is fed by the Crater Springs via Spring Creek through Sphagnum Bog. Impacts from livestock tresspass may be occurring.

Fisheries: The park streams were repeatedly stocked from 1889 until the 1930's with rainbow trout, Salmo gairdneri, brown trout, Salmo Trutta, brook trout, Salvelinus fontinalis. Crater Lake was stocked with rainbow trout, brown trout, and kokanee, Oncorhynchus nerka. Remnant populations still exist in most streams and the lake. Fishing regulations are currently based on the Oregon regulations, though no license is required. The Klamath bull trout, Salvelinus confluentus is native to Sun Creek and considered very rare by the State of Oregon.

Alternative Actions and their Probable Impacts:

A. No Action (Current Action): There are currently no monitoring programs for the surface water resources in CRLA except for the lake. Periodic sampling occurs by the USGS of springs to determine an outlet from Crater Lake. Impacts on backcountry water resources are negligible due to low use levels. A voluntary creel census program was initiated in 1983 to determine number of fishermen on the lake.

Impacts: Under this alternative potential impacts on Munson and Dutton Creeks would continue unmitigated. No data would exist on aquatic impacts from park use.

B. Alternative B - Study streams: Initiate a study program on selected streams and springs to determine impacts from human and/or stock use. Research the role of the fish in Crater Lake as related to the caldera ecosystem. Encourage USGS to continue their program.

Impacts: More data would be gathered for management decisions. Data would be gathered for determination of impacts to aquatics along the boundaries from trespass livestock use (see CRLA-N-4). Data gathered will be useful in establishing agreements with adjacent land managers for the exclusion of livestock from park lands. Water data will assist in comparisons with springs inside the caldera (see CRLA-N-2).

Recommended Course of Action: It is recommended that the current actions and Alternative B are combined into a program. Munson and the upper portions of Castle Creek should be the object of an aquatic resource study with particular emphasis on impacts from Munson Valley/Rim Village use. Munson should be checked for petroleum products impacts from the maintenence facility and for residual impacts from the 1975 sewage spill. USGS will be encouraged to continue chemical analysis of the springs with possible assistance from the Park for analysis of biological parameters (phytoplankton) that would link them to the lake.
The Creel census will be continued to monitor fish catch and fishermen use. Fish surveys may be instigated in the lake to determine any impact on the lake ecosystem from their presence.
Some sampling of potable backcountry springs may be recommended when there is a conflict between human and packstock use.
The regulations for fishing within the park, particularily those that relate to the lake may be re-evaluated as of the result of research into the fish dynamics.
Additonal research will be sought on the rare Klamath Bull trout in Sun Creek.

B. Cultural Resources Management Program

1. Major Historical Themes:
Four major historical themes can be identified in the history of Crater Lake National Park: a) Northern Plateau Indians b) exploration and discovery, c) American conservation movement, and d) park administration. Historical remains or oral traditions have been identified for all themes but physical structures are associated only with park administration. The most comprehensive document on the history of CRLA is the "Historic Resource Study" by Linda W. Greene, published by the NPS in 1984.

a. Northern Plateau Indians

The first nomadic inhabitants of this area began arriving at least 13,000 years ago, (Greene, 1984), around the time of the last ice age. Peoples with a more specialized lifestyle arrived in the Klamath Basin about 7,500 - 10,000 years ago. Archeological evidence found at Fort Rock Cave east of the park suggests that the climactic eruption of Mt. Mazama approximately 6840 years ago, was witnessed by these people, (Kirk, 1975). Detailed Indian legends survive that attempt to explain the geological events culminating in Mount Mazama's final eruption.

By the time of white settlement of the area (approximately 1850's), Crater Lake was within the domain of the Klamath Indians. It was rarely visited by people other than medicine men, primarily because of the reverence generated by their religious belief that it was the dwelling place of powerful spirits.

Very few physical remains representative of this theme have been identified within the Park. Trails formerly used by the Klamaths on their way to berrying grounds converged on Annie Spring and are still traceable, although abandoned and overgrown. No ceremonial quest sites have been positively identified.

b. Discovery and Exploration

In the wake of the California gold rush, practically the entire West became the hunting ground for gold seekers. In 1852, when a strike in Oregon Territory around present-day Jacksonville became known, would-be miners eagerly hurried north from California, among them was John Wesley Hillman. Searching for a rumored "Lost Cabin Mine," Hillman chanced upon Crater Lake on June 12, 1853 and named it "Deep Blue Lake" (Tancil, 1978).

It was again the search for gold that led to the second "discovery" in 1862, by Chauncey Nye, while leading a group of prospectors. He named it "Blue Lake". In 1865, soldiers stationed at Fort Klamath rediscovered it and, unaware it had been previously named, called it "Lake Majesty." Finally in 1869, the lake was given its present name by a camping party from Jacksonville. No physical evidence has been found associated with this theme. However, the papers of William Gladstone Steel contain accounts written by the lake's various discoverers.

In July 1869, a party led by James M. Sutton descended with a small boat to the lake and paddled to Wizard Island where they renamed the lake "Crater Lake". The lake was photographed for the first time in 1874 by Peter Britt. In 1883, a United States Geological Survey team visited the lake, examined its volcanic structure, and compiled a report.

Efforts to explore the lake by boat were made by Captain Clarence E. Dutton detailed to the USGS, and Steel in 1886. The Cleetwood, a 26-foot wooden-hulled boat used by the party was sunk near Wizard Island after the survey was finished. Remains of this craft were tentatively located by National Park Service divers in 1979.

c. Conservation Movement to Protect the Lake:

In 1885, William Gladstone Steel visited Crater Lake and, after viewing it resolved that it should be included within a national park, and committed the rest of his life--and money--to its establishment and care.

Bills were introduced in Congress for making Crater Lake a National or State Park, the first one being 1886, followed by others in 1888, 1890, and 1892. None were successful. In the meantime, President Cleveland in 1885 withdrew the encircling lands from settlement by Executive Order. Again, for the protection of the area, President Harrison established Crater Lake Forest Reserve in 1892, which in 1893, became part of the Cascade Range Forest Reserve.

The story of Steel's campaign for Crater Lake cannot be separated from the then young but growing conservation movement. Scientific groups and individuals, alarmed over the ever-increasing misuse and destruction of our natural resources, began demanding that the government assume responsibility for protecting the public lands. The most important piece of legislation at this time in the American forestry movement was the Forest Reserve Act of 1891. This authorized the President to set aside by special proclamation National Forest Reserves out of public domain lands. Congress enacted in 1897, a pioneering conservation measure that established the U.S. Forest Service, thereby enacting into law the principle of government responsibility for protecting and administering certain public lands for the benefit of all. Theodore Roosevelt had early been an advocate of this principle, even before he became President and, soon after his succession to that office prodded Congress to pass the Crater Lake National Park Act. With his signing of the bill in 1902, the country had its sixth National Park.

This theme is represented by the papers of William G. Steel. Artifacts associated with older management practices and fire control survive in the park collection. The Steel papers comprise eleven volumes of collected memorabilia which describe the actions of Steel and other early managers concerning the park.

d. Park administration:

Between 1915 and 1932 Crater Lake National Park underwent a period of administrative development in the Munson Valley and Rim Village areas. The principal architect was Merel Sager, who chose as his central architectural theme massive stone masonry and steeply pitched shingle roofs. All of these structures remain today and are classic examples of NPS "rustic" architecture.

In an effort to recognize structures within CRLA related to its administration as important cultural resources, one has been listed on the National Register of Historic Places (NRHP) while others are on or are being considered for the park's List of Classified Structures for possible future listing on the NRHP.

The following list of structures in CRLA are currently on the LCS or being considered:

Bldg	Bldg#	Year of Constr.	LCS ID#
Administration Office Building	001	1934-36	12011
Exhibit Building	066	1921	12970
Sinnott Memorial Building	067	1930-31	00241
Ranger Dormitory	002	1932-36	12012
Employee's Residence	024	1927	12017
" "	025	1927	12016
" "	028	1927	12015
" "	030	1927	12014
" "	031	1927	12013
" "	032	1927	12095
Superintendent's Residence	019	1932-33	12018
Watchman Fire Lookout	168	1932	12019
Crater Lake lodge	565	1915	May 5, 1981 listing on NRHP
Old Community House	116	1920-24	Not listed
Machine Shop	005	1932	" *
Sign Shop	037	1940	"
Garage and Woodshed	033	1934-35	"
Mess Hall/Bunkhouse	036	1930	" *
Transformer House	036	1928	"
Meat House	013	1928-1929	" *
Naturalist's Residence	020	1932	" *

* These atructures are being currently considered for the CRLA LCS.

A complete description of the cultural resource value and the unique characteristics of each of the above structures can be found in the "Historic Resource Study" June 1984 by Linda Greene.

2. Status of Planning and Documentation:

a. Archeological: A study was completed in 1964 by Wilbur A. Davis entitled "Archeological Surveys of Crater Lake National Park". These archeological surveys found little evidence of Indian occupation in the Park, because, as Davis concluded, the Crater Lake area did not provide very much for Indian groups dependent upon hunting and gathering for subsistance. An update of the Davis report and an archelological base map are needed to collate and compile current data on environmental, ethnographic, and archeological material related to Crater Lake and its surrounding area.

b. Historic Resources: "Historic Resource Study, Crater Lake National Park" was completed in June 1984, by Linda Greene.

c. Administrative History: A "Chronological History and Important Event Log, Crater Lake National Park" by Lloyd and Larry Smith. It is updated through 1982. The Steel papers and scrapbooks are a further source. An administrative history written by a historian is needed, as described in NPS-28, Chapter 5, Page 4. This is programmed for FY 86 and 87.

d. National Register: The Crater Lake Lodge was entered upon the National Register of Historic Places on May 5, 1981. Additional structures will be evaluated for resource nomination for Crater Lake.

e. List of Classified Structures. The LCS was drafted in 1976 but needs a reassessment of existing structures and probable updating. This list is being updated as a result of the inventory of historic structures of Oregon parks.

f. Museum Catalogue: The museum collection contains over sixteen thousand objects. Cataloguing and preservation of historical documents and photographs is continuing. Nitrate base films are being reproduced on acetate bases to provide record copies. Antique ranger and firefighting equipment are being catalogued by volunteers. The library files contain over 1,000 historical research papers and manuscripts. Most important to the themes of Administration and Interpretation are the papers and scrapbooks of William G. Steel. These have been duplicated and the originals are stored in the Pacific Northwest Regional Office in Seattle, Washington, pending acquisition of adequate storage facilities at Crater Lake National Park. The Applegate plant collection and the collection of Indian projectile points await further study and research. Original portraits and paintings of Mt. Mazama need to be reproduced so that duplicates may be displayed at Sinnott Memorial and at Park Headquarters. The originals will then be stored in a controlled atmosphere room housing the museum collection. The Applegate herbarium collection is invaluable as a representation of the vegetation of the park in the 1920-30's. Voucher specimens are to be preserved. All data and items collected by researchers need to be incorporated into the park collection.

3. Overview and Needs: Cultural Resources

This section represents a prioritization of the cultural resource project accomplishments by fiscal year. These statements are brief synopses of the project statements. This section will be updated on an annual basis to reflect accomplishments and changes in priority.

The funding identified for each program is identified by fiscal year and broken into three categories:

Current Funding: This category indicates the total funding from all sources the park is now using to implement the program, including all Resource Management staff salaries.

New Funding Needed: This category indicates the funding needed to implement the recommended Alternative(s). This column can be used each year to develop special resource funding requests.

Total Program: This category indicates the a sum of the "Current Funding" and the "New Funding Needed" columns. This represents the total necessary funding for a specific program.

Rehabilitate Crater Lake Lodge: (CRLA-C-1)

Crater Lake Lodge has documented structural and aesthetic problems that diminish its historical integrity. Its location and limited season may not fit with current CRLA management policies and visitor use needs. More evaluation and study is needed before alternatives can be developed.

Current Program and Funding Needs (thsds)

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program

The future years' funding will depend on the results of the FY 85 study.

Preserve Historic Structures: (CRLA-C-2)

It is recommended that Historic Structure Reports and Historic Structure Preservation Guides by developed for all structures within CRLA. Structures will then be maintained in accordance with proper historic preservation techniques and those structures eligible will be nominated for inclusion on the National Register.

Current Program and Funding Needs (thsds)

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program
86	No action	0.0	0.0	0.0
87	Develop Historic Preservation Guides	0.0	35.0	35.0
88	Develop Historic Preservation Guides	0.0	35.0	35.0
89	Structure maintenance	0.0	10.0	10.0
90	Structure maintenance	0.0	10.0	10.0

Conserve Museum Collection: (CRLA-C-3)

It is recommended that a temperature and humidity controlled collection storage room be constructed within an existing CRLA structure. The room will be large enough to accommodate existing and anticipated future collections. A seasonal curator will be hired to complete accessions and cataloging, until such time that a permanent curator can be hired.

Current Program and Funding Needs (thsds)

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program
86	Seasonal curator	1.1	0.0	1.1
87	Permanent curator	0.0	15.0	15.0
	Update collections preservation guide	0.0	8.0	8.0
		0.0	23.0	23.0
88	Permanent curator	0.0	16.0	16.0
89	Permanent curator	0.0	17.0	17.0
90	Permanent curator	0.0	18.0	18.0

Provide Oral History Documentation: CRLA-C-5

It is recommended that tape recordings and transcriptions be made of interviews with informed individuals. The transcribed information will be systematically stored for retrieval.

Current Program and Funding Needs (thsds)

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program
86	No action	0.0	0.0	0.0
87	permanent curator conducts interviews	0.0	5.0	5.0
88	transcribe material	0.0	10.0	10.0
89	conduct more interviews	0.0	2.0	2.0
90	No action	0.0	0.0	0.0

CULTURAL RESOURCE MANAGEMENT PLAN
CRATER LAKE NATIONAL PARK
OVERVIEW AND NEEDS

Compile Administrative History: CRLA-C-6

It is recommended that a professional historian be contracted to write an administrative history of CRLA. Particular emphasis would be placed in the use of the oral history documentation and documentation of the lake use/research history.

Current Program and Funding Needs (thsds)

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program
86	Hire professional historian to develop administrative history	21.0*	0.0	21.0
87	Continue Admin. History	0.0	25.0	25.0
88	No Action	0.0	0.0	0.0
89	No action	0.0	0.0	0.0
90	No action	0.0	0.0	0.0

* Regional Cultural Resources Funding

CULTURAL RESOURCE MANAGEMENT PLAN
CRATER LAKE NATIONAL PARK
OVERVIEW AND NEEDS

Compile the History of Crater Lake in the Conservation Movement: CRLA-C-7

It is recommended that a professional historian research and develop a comprehensive document detailing the history of CRLA in the conservation movement. This will be completed in part by the Administrative History to be done in FY 86 and 87.

Current Program and Funding Needs

Funding for this program will not be requested until 1990.

CULTURAL RESOURCE MANAGEMENT PLAN
CRATER LAKE NATIONAL PARK
OVERVIEW AND NEEDS

Update Archeological Base Map and Overview: CRLA-C-8

It is recommended that the archeological basemap and park overview be prepared. Particular areas should be surveyed for artifacts.

Current Program and Funding Needs (thsds)

Fiscal Year	Description	Current Funding	New Funding Needed	Total Program
86	No action	0.0	0.0	0.0
87	no action	0.0	0.0	0.0
88	complete arch. basemap and overview	0.0	10.0	10.0
89	continue arch. basemap and overview	0.0	15.0	15.0
90	No action	0.0	0.0	0.0

CULTURAL RESOURCES MANAGEMENT PLAN
FIVE YEAR PROGRAMMING SHEET

Date: 6/15/85 page 1 of 1

Action type: M=maintenance, P=protection, O=monitoring, R=research

LA RK / PNR REGION / OR STATE ___x___CULTURAL

Funding source: F.B.= Current park base, CULT= request for cultural resources funding, ONPS= request for increase to park base

PRIORITY	RMP NO.	PACK NO.	PROJECT TITLE	ACTION TYPE PERCENT M,P,O,R*	FUND SOURCE	86 NPS MY	86 COST/ THOS.$	87 NPS MY	87 COST/ THOS.$	88 NPS MY	88 COST/ THOS.$	89 NPS MY	89 COST/ THOS.$	90 NPS MY	90 COST/ THOS.
1	CRLA-C-1	---	Rehabilitate Crater Lake Lodge	R		Funding request dependent on study results									
2	CRLA-C-3	---	Conserve Museum Collection	M,P	P.B.		1.10								
					CULT						8.00				
					ONPS			1.00	15.00	1.00	16.00	1.00	17.00	1.00	18.00
3	CRLA-C-2	---	Preserve Historic Sturctures	M,P	P.B.										
					CULT				35.00		35.00				
					ONPS							0.50	10.00	0.50	10.00
4	CRLA-C-5	---	Provide Oral History Documentation	R	P.B.										
					ONPS				5.00		10.00		2.00		
5	CRLA-C-8	---	Update Archeological base map	R	P.B.										
					CULT						10.00		15.00		
6	CRLA-C-6	---	Compile Administrative History	R	P.B.										
					CULT		21.00		25.00						
7	CRLA-C-7	---	Compile History of CRLA in Conservation Movement			No funding request at this time.									

5. Cultural Resource Project Statements

The following project statements describe in detail the status of information, the current management actions, the nature of the cultural resources to be protected and all realized and potential threats to those resources. The project statement reviews alternative actions, their environmental and social consequences, and recommends a proposed action. These project statements are intended to be updated as needed. The project statement number, such as CRLA-C-1, does not necessarily represent a numerical priority as the priority may change over time. The project statement number should not be changed so as to provide a tracking system for each project for future years. As new projects are identified, they should be assigned new numbers and added to the overall list.

CRLA-C-1: Rehabilitate Crater Lake Lodge:

Statement of Issue:

Crater Lake Lodge was listed on the National Register of Historic Places on May 5, 1981. Crater Lake Lodge is of regional significance as an example of the architecture associated with the early 20th century movement for development of the western national parks and because of its association with the development of the tourism and recreation in Oregon. The original portions of the lodge were largely completed between 1909 and 1915; a four story annex was constructed 1922-24 and a lakeside veranda was built in 1928. The lodge's exterior appearance and public ground floor areas have not been greatly altered since 1924 and are a surviving example of the western lodges of that era. Problems of construction of the lodge were compounded by lack of funds for the project, remoteness of the site, poor roads, and one of the heaviest snow accumulations in the Cascade Mountain Range.

The general appearance of the lodge's exterior has not changed significantly since construction, however, the condition of the building has deteriorated. The structural framing is not sufficient to support heavy winter snowsand as a result, the lounge portion of the building has been reinforced with the installation of cables and turnbuckles secured to the exterior masonry.

The interior public spaces appear much as they did in early photographs, but columns have been added to mitigate structural deficiencies which are the result of the failure of the on-site contractors to follow the original construction plans by H.L. Hockenberry & Co., Architects.

In the first floor public use are, a dropped ceiling of rough sawn boards has been added to cover the addition of plumbing into the guest rooms, and the floor has been carpeted. Finishes in the corridors and guest rooms have been significantly altered over the course of the lodge's operation.

On-going studies and a recently completed one by the National Park Service's Denver Service Center, and engineering reports from Haner, Ross & Sporseen discuss certain structural defects in the lodge.

Operating under Package #220, interim improvements were made in FY 1981 to upgrade safety and fire rating standards throughout the building. The facing of the structure on the lake side was reshingled to replace the deteriorated siding and to restore a fresh appearance. The remainder of the lodge safety improvements were completed by June 1, 1982. A new fire alarm and sprinkler system was installed in 1983.

Questions arose in 1981 as to the substrate under the lodge. Studies by Rod Cranson and Charles Bacon indicated that the rim in the lodge area is receding at an unknown but perceptible rate. Six test holes were drilled around the lodge in 1981 by the USGS. Water flows beneath the overlying rubble near an interface with silt layers. This flow could contribute to gradual slope deterioration in front of the building and continued structural failure. Further tests are needed to determine movements.

An Historic Structure Report was drafted in 1982 to guide the structural rehabilitation of the lodge. The lodge rehabilitation work was scheduled to begin at the close of the 1982 operating season. However, Package #220 was dropped from the program on December 4, 1981, so Phase I Structural Rehabilitation will not proceed.

A Development Concept Plan was released in 1984 by the National Park Service to address the future of lodging within CRLA. A basic assumption was made that this future lodging would not be in the Crater Lake Lodge. Alternative uses were explored including entire demolition.

In the spring of 1985, a contract was released to study the requirements of renovation for a 20 and 40 year life for "rustic" accomodation. The results of this study are expected in late 1985.

Recommended Course of Action: Before alternative actions on the status of Crater Lake lodge can be formulated, the 1985 independent architechural and engineering study must be complete. At that time alternatives will be formulated with accompanying NEPA and NHPA compliance documentation.

CRLA-C-2: Preserve Historic Structures:

Statement of Issue:

There are fourteen structures presently listed on the CRLA List of Classified Structures, (LCS). Historic Structure Reports (HSR) and Preservation Guides (HSPG) are needed for all LCS structures throughout the park. The "Historic Resource Study" (Greene, 1981) recommends that other structures be added to the LCS and that they be considered as a group including the Administration Building, Ranger Dormitory, eight employee residence structures, seven maintenance/administrative structures. All were nominated as the Munson Valley Historic District.

Whether or not these structures are nominated to the National Register, HSR's and HSPG's are needed for these buildings in Munson Valley and at Rim Village and Watchman Lookout. In order to maximize the useful life of these facilities, a study is needed of the headquarters development complex, the Rim Village buildings (Sinnott Memorial and Exhibit Building), Watchman Lookout and the Community Building (Rim Center). This would give guidance to park management as to the methods which should be used for renovation and maintenance.

The original headquarters complex was a significant statement by the National Park Service concerning site planning and architectural design. The Sinnott Memorial was the prototype for these designs. Watchman Lookout is one of the best remaining fire lookout stations in the United States. Deferred maintenance has recently focused attention on these facilities and the need to deal appropriately with them. Without an HSR and an HSPG, it is likely that significant features in these buildings will be lost or altered. Renovation is needed immediately in many buildings of this complex and at Rim Village; some quarters have already been renovated with varying degrees of success. The studies would give guidelines for renovation work to ensure that important architectural characteristics are retained and that necessary maintenance is not overlooked during a renovation.

Architectural and Engineering studies by the firm of Zaik, Miller and DiBenedetto were conducted on the structures in Munson Valley in 1984/85. The studies provided the basic information for HSR's. As the structures are renovated, HSPG's can be produced. HRS's are needed for those structures at Rim Village that will retained under the Development Concept Plan (see CRLA-N-14).

Alternatives and their Probable Impacts

A. No Acton (Current Action): Do not complete HSR and HSPG studies and continue present cyclic maintenance practices to preserve these structures for adoptive uses.

Impacts: This would be most expedient course for maintenance but would possibly cause irreversible damage to the historic fabric of the structures, should they ever be nominated for the National Register as an Historic District or as individual structures.

B. Alternative B - Raze the structures: Build a new administrative complex at lower elevation out of the heavy snow region.

Impacts: This would eliminate management and maintenance problems in preserving the structures but would be a violation of the intent of the Historic Preservation Act of 1966.

C. Alternative C - Continue the A & E studies at Munson Valley with the development of HSPG's upon completion of rehabilitation. Program HSR's on Rim Village structures after completion of DCP and determination of which structures will remain. Complete HSR and HSPG for Watchman Lookout.

Impacts: This would provide for adaptive use of the structures while preserving their historic fabric. All structures older than 40 years will be inventoried and classified structure reports will be complete for all historic structures.

Recommended Course of Action

The preferred course of action is Alternative C. This would expedite the planning process for HSR's and HSPG's and would allow implementation of procedures to preserve this significant architectural statement in the Park's history. In FY84 all LCS buildings were inventoried and field inventory reports were made on all structures over 40 years old. Structures will be evaluated for National Register eligibility as the first step in the preparation of a multiple resource nomination for Crater Lake. Evaluation of the inventory data should aid in the establishment of priorities for programming HSR's and HSPG's. Maintenance could then proceed with needed repairs. Historic fabric would be documented and maintained according to the requirements of the National Historic Preservation Act and Executive Order 11593. Based on the A & E recommendations of 1984/85, the Munson Valley structures will be rehabilitated as funds come available. HSPG's will be completed as the rehabilitation is done. All HSPG's will follow NPS policies for preservation maintenance.

CULTURAL RESOURCES MANAGEMENT PROGRAM
Crater Lake National Park

CRLA-C-3: Conserve Museum Collection:

Statement of Issue:

The Park museum collection exceeds an estimated 16,000 individual objects and specimens specific to Park needs as identified in the Scope of Collections Statement dated 1981. A survey of conditions of the collection has indicated that nearly 900 separate accessions covering the bulk of the collection have not been completed. An estimated 6125 items need immediate cataloging in order to comply with NPS-28 and Title 36 CFR Part 2.5 regulations. The Park files contain an estimated 4500 photographs, plus 8 albums of uncataloged prints.

The Collection Preservation Guide of 1968 needs updating and the estimated 16,000 specimens need preservation treatment and proper storage.

The entire photo and artifact collection is housed in metal cases in a storage facility without temperature and humidity control. The current Scope of Collections is inadequate. Some use of collections specimens by interpretation has occured. The present collection is housed in a wood-frame structure with neither fire nor theft security. A non-flammable structure designed for proper security and atmospheric controls is not available within the Park.
Many projects related to both naturla and Cultural resources include the collection of biological specimens or historic or archeological artifacts. In the past, these items have not been incorporated into the museum collection at CRLA. This is not in compliance with Title 36 CFR 2.5 (g).

In addition to other collection items, the park has some historic and or rare books in the park library. The park library is used by park staff for reference. Historic books are stored in the locked metal cabinets.

Alternative Actions and their Probable Impacts:

A. No Action (Current Action): Currently there is very slow progress on accessioning items within the Park collection. Current staffing is inadequate to accession all items. New items are being added by contribution of cultural materials such as photographs and books. New biological materials are being collected as part of lake monitoring program and other research. The existing facility would continue to be used for collection storage.

Impacts: Items improperly accessioned or not accessioned may be lost all together, or damaged to reduce or destroy significance. The current facility is open to fire damage, theft and unauthorized use of specimens. Specimens will continue to be lost or damaged and removed from the cultural/biological history of the park. The existing facility could easily be damaged or lost entirely due to fire. Atmospheric control is very difficult as the room is uninsulated and not humidity controlled. Fluctuations in humidity could damage specimens.

B. Alternative B - Hire a curator and construct a facility for museum collection: The first step in this alternative is to develop a comprehensive Scope of Collections per NPS-28. Hire a curator and construct an atmospherically controlled museum within an existing CRLA structure.

Impacts: The specimens will be preserved according to NPS-28.

Recommended Course of Action: It is recommended that Alternative B be implemented. A Scope of Collections will be drafted by the RM division and reviewed by Region. A seasonal curator will be hired to begin accessioning and evaluate collection needs. Funding will be sought to hire a full time curator/historian. Renovation of existing Park administrative structures will include plans for an atmospherically controlled museum/collection room. All items collected under approved collection permits and those items collected in the park research program will be incorporated into the collection per Title 36 CFR 2.5 and NPS 28. The park library will be reviewed for books of archival value and those incorporated into the park collection for protective storage.

CRLA-C-4 has been combined with CRLA-C-3

CRLA-C-5: Provide Oral History Documentation:

Statement of Issue:

The recorded history of Crater Lake National Park and its environs is sparse for the period before 1885 and after 1934, and thus there is little cultural data incorporated into its administrative documentation and interpretive activities.

A number of people from nearby Indian tribes and former Park employees have extensive knowledge of the Park and its formation and administration. Before the information is lost, every effort should be made to contact these people and record their histories.

The three areas of concern are: 1) the ancient lifestyles and culture of local Indians and their impressions of Mazama's climactic eruptions, 2) early exploration and discovery of the lake, and 3) Park management and interpretation since 1934.

Alternatives and their Probable Impacts

A. No Action (Current Action): The current action is to interview and tape record information from knowledgeable individuals on a sporadic basis. No transcribing is occuring.

Impacts: This is a very slow process that will not complete all necessary oral histories before informed individuals are deceased. Valuable information will be lost and large blocks of time may go undocumented.

B. Alternative B - Interview and tape record knowledgeable individuals: Using ethnographic or oral history methods, tape recording interviews with individuals of knowledge about the history of CRLA.

Impacts: Tape recordings are temporary storage at best and subject to loss, damage and erasure, with potential for loss of all information.

C. Alternative C - Transcribe the information onto hard copy for storage: Although this is more costly, it assures permanent preservation of this valuable information.

Impacts: This will insure permanent record of events.

Recommended Course of Action

Interviewing and tape recording conversations and transcribing the information onto hard copy for storage is the preferred alternative. This a more costly process but is preferable because it provides permanent storage and flexibility in usage.

The interviews would consist of both predetermined and discretionary questions. The resulting tapes would be transcribed and systematized. The person being interviewed would be allowed to review the manuscript. Tape recordings could also be used in the development of a variety of audio visual programs for Park visitors and orientation packages for new employees.

This project would help to fulfill the objectives stated in the General Management Plan for Crater Lake and the Interpretive Propectus in that it would provide material for the Park administrative history and would give background for interpretive programs "to enrich the visitor experience by emphasizing the life, culture, and history of local inhabitants and Park management".

This project completion will be attempted in part through the implementation of CRLA-C-6 "Compile Administrative History" and CRLA-C-8 "Archeology Overview and Base Map". Both of these projects will provide a phased basis for the CRLA oral history.

CULTURAL RESOURCES MANAGEMENT PROGRAM
Crater Lake National Park

CRLA-C-6: Compile Administrative History:

Statement of Issue: An administrative history done by a historian is needed. Facts about the origin, establishment, development and administration of the Park are scattered among many documents. No single source provides the definitive history of Crater Lake. The "Historic Resource Study" (Greene, 1984) gives stories of physical structures. The scrapbooks of William G. Steel give a personal account of early efforts to establish the Park and early administration philosophy. However, later developments after Steel's death in 1934 are not consistently documented. A chronology of major events has been distilled by seasonal Rangers Lloyd Smith and Larry Smith, but it needs updating to include data on Park legislation, cooperative agreements, personnel, friends of the park, and other pertinent facts on park operations.

Of particular importance is the administrative history of the management and scientific investigations of Crater Lake itself. Information on early expiditions, research, boats, fish and other animal and plant life would be of invaluable assistance in current lake research and interpretation.

Alternative and Their Probable Impacts:

A. No Action (Current Action): Not to compile an administrative history.

Impacts: This would leave the Park in a difficult position of trying to interpret the historic resources and to manage resources without benefit of usable accumulated documentation. History may be repeated.

B. Alternative B - Absorb the compilation project and produce the administrative history in-house: Seasonal Rangers could use the chronology of events as a basis for expansion into a complete history. Some visitor information and interpretation functions would have to be curtailed to provide time for the project.

Impacts: The document might be less useful to management since it would be done by non-professional historians.

C. Alternative C - Contract to have a historian write an administrative history of the Park.

Impacts: This would give best product with least disruption of on-going interpretation projects. All pertinent historical data would be united into a single document.

Recommended Course of Action

The preferred alternative is to contract for a historian to write an administrative history of the Park. This would be the most expensive method but would be the least disruptive of the interpretive program and, equally important, would assure that the park would have a professional, useful document for management. The Administrative history will be a two year study with oral history and archival review to dominate the first year. Park staff will continue to maintain a record of significan events and decisions affecting park management.

CRLA-C-7: Compile the History of Crater Lake in the Conservation Movement:

Statement of Issue:

A history of Crater Lake related to the early conservation movement, done by a historian, is needed. Crater Lake is one of the oldest units of the National Park System. The efforts of William G. Steel and others beginning in 1885 made Crater Lake National Park one of the early victories of conservationists. The conservation struggle has continued, and the story of Crater Lake has much to tell about establishment and management of parks. Facets of this story are contained in the "Historic Resource Study", the Crater Lake Lodge draft structure report, and the Steel scrapbooks. More facets of this story will be contained in the administrative history of the Park. A single document describing the Park's role in the conservation movement, compiled from the above studies, would have greater and more convenient utility for managers and interpreters and provide a coherent narrative for public distribution.

Alternatives and Their Probable Impacts:

A. No Action (Current Action): Not to compile history of Crater Lake in the Conservation Movement.

Impacts: This would leave the Park in a difficult position to interpret the Park's role in relation to the conservation movement.

B. Alternative B - Compile history by park staff:

Impacts: Visitor services could be curtailed while personnel prepared the document and the document could probably be less professional and less useful than if done by a historian.

C. Alternative C - Contract to have a DSC historian write a concise history of Crater Lake in the Conservation Movement. All pertinent historical data would be united into a useful document.

Impacts: This would provide the best narrative with the least disruption of on-going interpretation projects.

Recommended Course of Action:

The preferred alternative is to contract for a historian to write a concise history of Crater Lake in the conservation movement. This method would be the most expensive but would assure that the Park would have a professional, useful document for interpretation, and would be least disruptive of the on-going interpretation program. A single, published narrative would provide a usable document on Crater Lake history for public distribution. The possibility of using a graduate student through a CPSU will be explored.

CULTURAL RESOURCES MANAGEMENT PROGRAM
Crater Lake National Park

CRLA-C-8: Update Archeological Overview and Basemap:

Statement of Issue:

An archeological survey of Crater Lake National Park was done by Wilbur A. Davis of the University of Oregon in 1964. Even though Davis found little evidence of Native American occupation in the area, recent claims of local Indian tribal members have brought new interest in possible former use of the area. A new study is needed to update the 20 year old archeological base map and overview of the Park related to environmental, ethnographic, and archeological material of Crater Lake and its surrounding area. Sites presently recorded should be ground-truthed by inspection. This study will satisfy legislative regulations to preserve archeological resources and provide up-to-date information for management and interpretation of cultural areas of Crater Lake National Park.

Alternatives and Their Probable Impacts:

A. No Action (Current Action): Do not update the Archeological Base Map and Overview.

Impacts: This would force the Park managers to rely upon outdated data not in compliance with Federal and National Park Service regulations. Undiscovered resources would be in danger of damage or destruction.

B. Alternative B - Provide new base map and overview of archeological resources.

Impacts: This would satisfy requirements of National Park Service-28 and 36 CFR-800 and provide better information for resource protection and interpretation of the park's cultural resources.

Recommended Course of Action

The preferred course of action is to provide a new overview and base map of archeological resources. This would allow the park staff to carry out its responsibilities to preserve, protect and interpret the park's cultural areas using the most up-to-date information available on location, status and meaning of the Park's archeological resources. Particular emphasis should be placed on determining "probable" areas of archeological resources.

II. Resource Management Plan Preparation, Review and Disk storage:

PLAN PREPARER:

Jonathan B. Jarvis, CRLA Resource Management Specialist

PLAN REVIEWERS:

CRLA staff
PNRO staff

DISK STORAGE:

This plan exists on a Wang PC under the following files:

Wordprocessor, subdirectory /wordp:

RMPOVAN.DOC	Title page thru Overview and Needs
RMP.DOC	Project Statements for Natural Resources
RMPCULT.DOC	Cultural Resource Plan
SHORTBIB.DOC	Selected CRLA References

Multiplan, subdirectory /multi:

Matrix	Blank Environmental Assessment Matrix
Matrix1-16	EA Matrices for Natural Resources
Matrix17-23	EA Matrices for Cultural Resources
5YRNAT	Five year programming sheet Natural Resources
5YRCULT	Five year programming sheet Cult. Resources

III. Environmental Assessment Matrices

This section presents each proposed project in the same order as they appeared in the Project Statement section of this plan. The proposed projects are presented in a matrix format so the cumulative impacts of each alternative may be thoroughly analyzed.

This section represents the compliance requirements of the National Environmental Policy Act of 1970.

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
NATURAL RESOURCES MANAGEMENT PLAN

ROJECT STATEMENT TITLE: Basic Resource Inventory: CRLA-N-1

EED FOR THE PROPOSAL: To provide baseline information on Park esources for support of management programs, decisions and compliance equirements.

ALTERNATIVES / ACTIONS	PROPOSED ACT.	NO ACTION	ALTERNATIVE B	ALTERNATIVE C
MPACT ATEGORIES	Active data collection, computer based, GIS	Continue passive data collection	same as proposed	
ark Data Base	collection of info. for priority projects with immediate accessibility.	collection of data in sporadic fashion will not provide information for priorities.	same as proposed	
ark Collections	specific items protected due to enforcement of CFR.	non-compliance with 36 CFR.	''	
ark Resources	protected by information availability.	not as protected		
egulations	conforms	does not conform	conforms	

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
NATURAL RESOURCES MANAGEMENT PLAN

PROJECT STATEMENT TITLE: Caldera Ecosystem Management: CRLA-N-2

NEED FOR THE PROPOSAL: To comply with PL-97-250, the park must operate a limnological program on the quality of Crater Lake water, and mitigate any man-caused action thought to impact the lake water quality.

ALTERNATIVES / ACTIONS	PROPOSED ACT.	NO ACTION	ALTERNATIVE B	ALTERNATIVE C
IMPACT CATEGORIES	Continue program with addition of boathouse	Continue program without boathouse	same as proposed	
Lake Quality	will develop data base for management decisions.	will develop summer data only	same	
PL-97-250	complies	complies partially	complies	
Visitor Exp.	will help protect deep blue color and provide info. for interpretation.	same	same	
Program Cost	initial cost of $30,000, yearly savings of $8,000 per annum	yearly cost of $8,000 will continue to remove boats by helicopter	same as proposed	
Caldera Ecosystem	provides protection	provides protection	same	

*Note: a separate EA will be completed for the Boathouse construction proposal.

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
NATURAL RESOURCES MANAGEMENT PLAN

PROJECT STATEMENT TITLE: Bear Management: CRLA-N-3

NEED FOR THE PROPOSAL: To inform the public and prevent bear visitor interactions that result in property damage, personal injury, or loss of the bear.

ALTERNATIVES / ACTIONS / IMPACT CATEGORIES	PROPOSED ACT. Implement Bear Management Plan	NO ACTION same as proposed	ALTERNATIVE B Discontinue program	ALTERNATIVE C Seek special regs. on food storage containers
Bears	animals will be protected unless repeated conditioning occurs	same	all bears protected	same as proposed
Visitor	protected, some intrusion due to food storage recommendation	same	some visitor/ bear incidents could occur with prop. damage and/or personal injury	some visitor intrusion from enforcement of regulation
Park property	protected	same	not protected	protected

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
NATURAL RESOURCES MANAGEMENT PLAN

PROJECT STATEMENT TITLE: Livestock Tresspass: CRLA-N-4

NEED FOR THE PROPOSAL: To manage and control impacts to sensitive park vegetation from trespass grazing domestic livestock

ALTERNATIVES ACTIONS / IMPACT CATEGORIES	PROPOSED ACT.	NO ACTION	ALTERNATIVE B	ALTERNATIVE C
	Develop Interagency agreement. Fence portion of boundary	Passive patrol and reporting	Enforce CFR 2.60 Increase patrols	
Vegetation	will protect specific sensitive areas. Overall vegetation will be protected from consumption and trampling.	consumption and degradation will continue.	same as proposed	
Soils	protect areas from compaction and/or erosion	impacts will continue	same as proposed	
Wildlife	reduced competition for wildlife from domestic grazing	competition will continue	same as proposed although some competition will continue	
Aesthetics	popular visitor areas will be protected from trampling	popular visitor areas will continue impacts	same as proposed	
Neighbor Relations	improvement through interagency agreement	same	could decline through enforcement of CFR 2.60	

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
NATURAL RESOURCES MANAGEMENT PLAN

ROJECT STATEMENT TITLE: Rare and/or Endangered Species - Animals CRLA-N-5

EED FOR THE PROPOSAL: As required by the Endangered Species Act of 973, the park manages the peregrine falcon. Other endangered/threatened animal pecies' status within the park is unknown.

ALTERNATIVES ACTIONS / MPACT ATEGORIES	PROPOSED ACT. Continue peregrine program. Begin Bald Eagle survey.	NO ACTION Continue peregrine program. No other survey.	ALTERNATIVE B Passive approach Discontinue peregrine program.	ALTERNATIVE C
eregrines	support reproductive success	same	may fail to reproduce	
ald Eagle	status will be ascertained	status will remain unknown	same	
SA compliance	complies	non-compliance	non-compliance	
ther T/E pecies	status will be ascertained	status will remain unknown	same	
nterpretation	info. will be developed for visitor interp.	some info. developed	no info. developed for visitors.	
isitor ecreation	may be restricted due to species requirements. If restrictions are necessary, NEPA compliance will be completed.	same	not restricted	

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
NATURAL RESOURCES MANAGEMENT PLAN

ROJECT STATEMENT TITLE: Rare and/or Endangered Species - Plants: CRLA-N-6

EED FOR THE PROPOSAL: To provide information on the status of plant pecies considered rare or endangered by the state of Oregon or by the USF&WS er the Endangered Species Act of 1973.

ALTERNATIVES / ACTIONS	PROPOSED ACT.	NO ACTION	ALTERNATIVE B	ALTERNATIVE C
MPACT ATEGORIES	Continue surveys of Pumice Grapefern and other species.	Study only the Pumice Grapefern	Study/Survey all rare plants	Discontinue Program
SA of 1973 ompliance	complies	partial compliance	complies	non-compliance
/E plant rotection	P. Grapefern and others	only Pumice Grapefern	all species	no species
ark information ase on T/E lants	will develop data base	will not develop data base	will develop data base	will not develop data base
ew plants ecorded	possible	will not occur	probable	will not occur

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
NATURAL RESOURCES MANAGEMENT PLAN

ROJECT STATEMENT TITLE: Vegetation Management: CRLA-N-7

EED FOR THE PROPOSAL: To provide a systematic means for identification
ad rehabilitation of vegetated areas impacted by human activity

ALTERNATIVES / ACTIONS	PROPOSED ACT.	NO ACTION	ALTERNATIVE B	ALTERNATIVE C
MPACT ATEGORIES	Develop specific action plans	passive survey of impact areas	Allow natural regeneration	
esthetics	will improve with implementation of action plans	will improve slowly	will improve eventually	
ative Plants	will be used to revegetate	will be used to revegetate	will reseed themselves	
xotic plants	may be introduced	may be introduced	will not be introduced	
oils	will prevent erosion and compaction	some erosion and compaction prevented	erosion and compaction may continue	
ildlife	temporary disturbance	same	minimal disturbance though will be displaced	

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
NATURAL RESOURCES MANAGEMENT PLAN

ROJECT STATEMENT TITLE: Pumice Field Management: CRLA-N-8

EED FOR THE PROPOSAL: To provide for the protection and rehabilitation f fragile pumice field vegetation impacted from illegal ORV use.

ALTERNATIVES / ACTIONS	PROPOSED ACT.	NO ACTION	ALTERNATIVE B	ALTERNATIVE C
MPACT ATEGORIES	Encourage research on desert and construct barrier.	Rake disturbed areas. Cite violators.	Research desert and construct barriers.	Discontinue program
oils	will protect from impact	no protection	will protect	no protection
umice Desert lants	provides data and protection	does not provide data or protection	provides data and protection	no data or protection
esthetics	some intrusion from barrier	some intrusion from tracks	some intrusion from barrier	some intrusion from tracks
ark data base	data gathered	no data	data gathered	no data

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
NATURAL RESOURCES MANAGEMENT PLAN

ROJECT STATEMENT TITLE: Hazard Tree Management: CRLA-N-9

EED FOR THE PROPOSAL: To provide a systematic approach to the urveying, identification and removal of trees that pose a hazard to property nd health.

ALTERNATIVES / ACTIONS	PROPOSED ACT.	NO ACTION	ALTERNATIVE B	ALTERNATIVE C
MPACT ATEGORIES	Implement Hazard Tree Plan	same		
ompliance with ase law of iddough vs. U.S 1968)	complies	same	none other considered due to lack of compliance with current case law	
rees	Some will be removed in visitor and administrative use areas.	same		
ildlife	some localized disturbance and loss of habitat	same		
isitor safety	Incidents will be reduced to minimum	same		
ederal/Private roperty	damage reduced to minimum	same		

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
NATURAL RESOURCES MANAGEMENT PLAN

ROJECT STATEMENT TITLE: Fire Management: CRLA-N-10

EED FOR THE PROPOSAL: To maintain a natural forest ecosystem through he reintroduction of fire, and the policy of allowing fires to occur under rescribed conditions with adequate monitoring.

ALTERNATIVES ACTIONS / MPACT ATEGORIES	PROPOSED ACT. Update FMP. Use natural and prescribed fire	NO ACTION Continue to use old Fire Mgmt. Plan.	ALTERNATIVE B Suppress all fires.	ALTERNATIVE C Update Fire Mgmt. Plan
egetation	Natural condition maintained.	unnatural conditions may occur.	unnatural conditions will occur.	same as recommended.
ildlife	some localized disturbance during fires with later habitat improvement.	some habitat improvement and some habitat loss.	habitat loss	''
moke Mgmt. and ir Quality	complies with EPA/State requriements.	non-compliance	complies	''
isitor xperience	some experiences reduced, some enhanced	same	same	''
orest cosystem	natural conditions maintained	unnatural conditions may result	unnatural conditions will result	''

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
NATURAL RESOURCES MANAGEMENT PLAN

ROJECT STATEMENT TITLE: Air Quality: CRLA-N-11

EED FOR THE PROPOSAL: To provide monitoring and development of atabase for determining changes in Class 1 Air Quality as required by L 91-604.

ALTERNATIVES / ACTIONS	PROPOSED ACT.	NO ACTION	ALTERNATIVE B	ALTERNATIVE C
MPACT ATEGORIES	Continue program with AQ shelter at Rim Village	Continue existing program	Discontinue monitoring	
ata Collection	more accurate data on AQ	data may be skewed due to Munson Valley influence	no data collected	
lean Air ct Compliance	complies	complies	non-compliance	
QRV's	better documentation and protection.	partial documentation and protection.	no documentation and protection	
isitor xperience	enhanced	enhanced	reduced	
tate Program ompliance	compliance	partial compliance	non-compliance	

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
NATURAL RESOURCES MANAGEMENT PLAN

PROJECT STATEMENT TITLE: Elk Management and Study: CRLA-N-12

NEED FOR THE PROPOSAL: To provide information through research on the status of elk population within CRLA for the development of protective management programs.

ALTERNATIVES / ACTIONS	PROPOSED ACT.	NO ACTION	ALTERNATIVE B	ALTERNATIVE C
IMPACT CATEGORIES	Initiate a comprehensive Elk Study	Continue plot counts. No new studies.	Discontinue all elk research.	
Elk Population database	will develop data	no data development	no data development	
Elk individuals	some individual loss during trapping and immobilization	no individual loss	no individual loss	
Vegetation	impacts/use documented	some documentation	no documentation	
Management Strategies	will be developed	will not be developed	will not be developed	

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
NATURAL RESOURCES MANAGEMENT PLAN

PROJECT STATEMENT TITLE: External Influences: CRLA-N-13

NEED FOR THE PROPOSAL: To provide a systematic method of identifying and quantifying activities outside the park boundaries that have potential and realized impacts on park resources.

ALTERNATIVES ACTIONS / IMPACT CATEGORIES	PROPOSED ACT. Continue review and monitoring of adjacent land activities with intensive monitoring of geothermal develop.	NO ACTION passive monitoring and agency coordination	ALTERNATIVE B same as recommended	ALTERNATIVE C Discontinue all monitoring of external influences
Park Resources General	Identify impacts	identify impacts	''	impacts not identified
Neighbor Relations	maintained working relationship	maintained working relationship	''	no relationship maintained
Park Resources related to Geothermal Development	identified and monitored	not identified	''	not identified
Compliance with enabling legislation and applicable laws	complies	may not comply	''	does not comply

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
NATURAL RESOURCES MANAGEMENT PLAN

PROJECT STATEMENT TITLE: Park Management and Visitor Use: CRLA-N-14

NEED FOR THE PROPOSAL: To identify and mitigate resosurce impacts from administrative and visitor use through monitoring, research and management strategies.

ALTERNATIVES ACTIONS / IMPACT CATEGORIES	PROPOSED ACT. Continue monitoring and do sociological research	NO ACTION Review planning and control visitor and admin.activities thru existing guidelines.	ALTERNATIVE B Initiate sociological research on visitor and administrative activities.	ALTERNATIVE C
Park Vegetation/ Wildlife	Impact identified with mitigating strategies	impact identified with no mitigating stragies	same as recommended	
Visitor Experience	may be enhanced though limited by mitigating measures.	no change	no change	
Administrative Use practices	may be limited to mitigate impacts	same	same	

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
NATURAL RESOURCES MANAGEMENT PLAN

PROJECT STATEMENT TITLE: Integrated Pest Management: CRLA-N-15

NEED FOR THE PROPOSAL: To systematically identify and develop appropriate management strategies for pest problems

ALTERNATIVES ACTIONS / IMPACT CATEGORIES	PROPOSED ACT.	NO ACTION	ALTERNATIVE B	ALTERNATIVE C
	Continue surveys and IPM plans. Survey structure for exclusionary work. Change Rim Village signs.	Conduct in-house surveys, develop IPM plans. Restrict use of pesticides.	Use pesticides routinely	
Wildlife	only those entering structures and are target species impacted	same	non target impacts	
Structures	Development of Control Strategies	no strategy development	protected	
Aesthetics	protected	partially protected	protected	
Public Health	protected	partially protected	protected	
Plague	monitored	monitored	controlled	
Visitors	some complaints about non-feeding	same	feeding will continue	
Exotic plants	monitored	monitored	partially controlled	

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
NATURAL RESOURCES MANAGEMENT PLAN

PROJECT STATEMENT TITLE: Aquatics and Fisheries: CRLA-N-16

NEED FOR THE PROPOSAL: To monitor the impacts on and current status of of the aquatics and fisheries of CRLA.

ALTERNATIVES / ACTIONS	PROPOSED ACT.	NO ACTION	ALTERNATIVE B	ALTERNATIVE C
IMPACT CATEGORIES	Continue Creel census. Initiate Munson/Dutton and fisheries study.	No monitoring. Continue Creel Census.	Initiate Munson/Dutton Creek Study.	
Impacts from Sewage treatment	Identified	not identified	identified	
Impacts from Munson Valley petroleum use	identified	not identified	identified	
Aquatics system	protected	not protected	protected	
Lake fisheries	data collected and impacts determined	little data collected	no data collected	

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
CULTURAL RESOURCES MANAGEMENT PLAN

PROJECT STATEMENT TITLE: Rehabilitate Crater Lake Lodge CRLA-C-1

NEED FOR THE PROPOSAL: The Crater Lake Lodge is listed on the National Register of Historic Structures but suffers from significant defects that will require extensive renovation and repair.

ALTERNATIVES ACTIONS / IMPACT CATEGORIES	PROPOSED ACT.	NO ACTION	ALTERNATIVE B	ALTERNATIVE C
	Complete study on rehabilitation by A & E.	no other alternatives considered at this time		
Lodge Preservation	will provide information as to needs and cost			
NHPA	compliance			
GMP	compliance			

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
CULTURAL RESOURCES MANAGEMENT PLAN

PROJECT STATEMENT TITLE: Preserve Historic Structures: CRLA-C-2

NEED FOR THE PROPOSAL: To develop historic structure preservation guides for CRLA structures to ensure proper maintenance techniques are applied.

ALTERNATIVES / ACTIONS	PROPOSED ACT.	NO ACTION	ALTERNATIVE B	ALTERNATIVE C
IMPACT CATEGORIES	Develop HSR and HSPG's	Do not develop HSR's and HSPG's	remove all structures	
NPS 28 and NHPA	complies	non-compliance	non-compliance	
Structure Integrity	cultural integrity maintained	cultural integrity not maintained	loss of structures	
Structure Maintenance	maintenance per cultural standards and guidelines	maintenance may not be per standards and guidlines	no maintenance	

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
CULTURAL RESOURCES MANAGEMENT PLAN

PROJECT STATEMENT TITLE: Conserve Museum Collection: CRLA-C-3

NEED FOR THE PROPOSAL: The park collection consists of over 16,000 items with an additional 6000 uncataloged items. To comply with NPS-28 and to preserve this historic record, conservation measures are needed

ALTERNATIVES ACTIONS / IMPACT CATEGORIES	PROPOSED ACT.	NO ACTION	ALTERNATIVE B	ALTERNATIVE C
	Write Scope of Col. construct facility. Begin cataloging with seasonal	continue slow in-staff progress. Use existing facility	same as proposed	
Collection	will be preserved	will not be preserved and some items lost		
Park historical and natural data base	information preserved	information lost		
NPS-28	complies	non-compliance		
CFR Part 2.	complies	non-compliance		

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
CULTURAL RESOURCES MANAGEMENT PLAN

PROJECT STATEMENT TITLE: Provide Oral History Documentation: CRLA-C-5

NEED FOR THE PROPOSAL: To document otherwise unobtainable information about the past management and history of CRLA through taping and transcribing for the purposes of management reference.

ALTERNATIVES ACTIONS	PROPOSED ACT.	NO ACTION	ALTERNATIVE B	ALTERNATIVE C
IMPACT CATEGORIES	Tape record and transcribe interviews	Only tape those that park staff has time to complete	Tape record only	same as preferred
Oral information	recorded, preserved and accessible	recorded sporadically some individuals will be deceased before recorded	recorded but subject to loss	
Park history	documented	not documented	recorded	
Interpretation	would provide reference document	would not provide document	would not provide document	

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
CULTURAL RESOURCES MANAGEMENT PLAN

PROJECT STATEMENT TITLE: Compile Administrative History: CRLA-C-6

NEED FOR THE PROPOSAL: To provide a written record of the administrative actions and developments from the establishment of CRLA to present.

ALTERNATIVES / ACTIONS	PROPOSED ACT.	NO ACTION	ALTERNATIVE B	ALTERNATIVE C
IMPACT CATEGORIES	Contract preparation of administrative history	Do not compile administrative history	Produce administrative history in house	same as proposed
Park Management	will provide guide for management	will not provide guide	will provide guide	same as proposed
Historical Accuracy	complete	N/A	may not be complete	''
Timeliness	completed in one season	N/A	may take many years	''

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
CULTURAL RESOURCES MANAGEMENT PLAN

ROJECT STATEMENT TITLE: Compile the History of Crater Lake in the Conservation Movement: CRLA-C-7

EED FOR THE PROPOSAL: To provide a written record of the history of RLA in the American conservation movement.

ALTERNATIVES / ACTIONS	PROPOSED ACT.	NO ACTION	ALTERNATIVE B	ALTERNATIVE C
MPACT ATEGORIES	Contract compilation of history	Do not compile history	Compile history by Park staff	same as proposed
nterpretation	would provide reference document	no reference provided	incomplete reference provided	
istorical ccuracy	complete	N/A	incomplete	

ENVIRONMENTAL ASSESSMENT MATRIX FORMAT (SUMMARY)
CULTURAL RESOURCES MANAGEMENT PLAN

ROJECT STATEMENT TITLE: Update Archeological Overview and Base Map: CRLA-C-8

EED FOR THE PROPOSAL: To provide an information base on the rcheological resources of CRLA and to identify potential cultural sites for rotection.

ALTERNATIVES / ACTIONS	PROPOSED ACT.	NO ACTION	ALTERNATIVE B	ALTERNATIVE C
MPACT ATEGORIES	Prepare new overview and basemap	update the old map	same as proposed	
rcheological esources	identified	may not be identified		
esource rotection	protected	unprotected		
PS-28 and ARPA	complies	non-compliance		

Appendix A

CRATER LAKE NATIONAL PARK

Research Bibliography

This bibliography is not intended to be comprehensive and only represents those most important topics by subject area.

A. Limnology
B. Botany
C. Fire Ecology
D. Entomology
E. Herpetology
F. Mammology
G. Ornithology
H. Geology
I. Sociology
J. Cultural Resources
K. Management
L. Other Publications

A. LIMNOLOGY

Atwood, W.W. 1935. The Glacial History Of an Extinct Volcano, Crater Lake National Park. Journal Of Geology, 43(2):142-168.

Byrne, J.V. 1962. Bathymetry of Crater Lake, Oregon. The Ore Bin. 24(10):161-164.

Byrne, J.V. 1965. Morphometry of Crater Lake, Oregon. Limnology and Ocenography. 10(3):462-465.

Carnegie Institute of Washington. N.D. Why Is Crater Lake So Blue? News Services Bulletin, Office of Publications, Carnegie Institution of Washington, Washington, D.C. IC(4):39-42.

Cranson, K.R. 1982. Crater Lake, Gem of the Cascades. The Geological Story of Crater Lake National Park, 2nd. Ed. Lansing Community College, Lansing, MI.

Diller, J.S. 1912. Geological History of Crater Lake. Dept. Interior, Natl. Park Serv. U.S. Govt. Printing Office. Public Inf. Bull., 31 p.

Diller, J.S. and H.B. Patton. 1902. The Geology and Petrography of Crater Lake National Park. U.S. Geological Survey, Professional Paper No. 3.167 pp.

Forbes, M.E., et. al. 1984. A Report on Crater Lake Water Quality, Crater Lake National Park, Oregon 1982-1983.
Crater Lake National Park Report to Congress. 35pp. +5 appendices.

Geiger, N.S. and D.W. Larson. 1981. Crater Lake: Its Planktonic Algae. Mazama:54-59.

Geiger, N.S. 1983. Pilot Photo Atlas, Crater Lake Phytoplankton, Crater Lake, Oregon. Beak Consultants. pp. not numbered.

Hasler, A.D. 1938. Fish Biology and Limnology of Crater Lake, Oregon. Journal of Wildlife Management. 2(3):94-103.

Hoffman, F.O. 1969. The Horizontal Distribution and Vertical Migrations of the Limnotic Zooplankton in Crater Lake, Oregon. M.S. Thesis, Oregon State University, Corvallis, OR. 60pp.

Hoffman, F.O. and J. R. Donaldson. 1979. The Significance of Crater Lake as a Scientific Benchmark for Limnological Research. U.S. Dept. of the Interior, National Park Service Transactions and Proceedings Series. 5:591-594.

Kibby, H.V.,J.R. Donaldson, C.E. Bond. 1968. Temperature and Current Observations in Crater Lake, Oregon. Limnology and Oceanography, 13(2):363-366.

Larson, D.W. 1970. On Reconciling Lake Classsification With the Evolution of Four Oligotrophic Lakes in Oregon. Ph.D. Thesis, Oregon State Univ., Corvallis, OR. 145pp

Larson, D.W. 1972 Comparative Limology and Phytoplankton Ecology of 4 "Oligotrophic" Lakes in OR., With Emphasis on Lake Typology. Northwest Science. 4(2):149-163.

Larson, D.W. 1972. Temperature, Transparency, and Phytoplankton Productivity in Crater Lake, Oregon. Limnology and Oceanography. 17(3):410-417.

Larson, D.W. 1979. Assoc. Of Phytoplankton Photosynthetic Rates With Vertical Temp. and Light Transmssion Gradients in Crater Lk. U.S. Dept. of Interior, National Park Service Transactions and Proceedings Series. 5:525-529. 1pp.

Larson, D.W. and M.E. Forbes. 1980. Optical Properties of Crater Lake, OR.:Variation in Secchi Disk Transparency. 1937-1979. In Proceedings of the 2nd Conference On Scientific Research In the Natl. Parks, Vol.5, USDI, NPS: 615-617.

Larson, D.W. and N.S. Geiger. 1980. Species Composition and Vertical Distribution of Pelagic Zone Phytoplankton In Crater Lake, OR:1940-1979. In Proceedings of the 2nd Conference on Scientific Research in the Natl. Parks, Vol. 2, USDI, NPS:96-104.

Larson, D.W. 1983. Annual Report on the Limnology and Water Quality Monitoring Program at Crater Lake National Park 1982. Crater Lake National Park. 42pp. + appendix.

Larson, D.W. 1983. First Annual Report on the Limnology and Water Quality Monitoring Program at Crater Lake National Park, Oregon, Final. Crater Lake National Park. 22pp. + 4 figures, 8 tables, 6 appendices.

Larson, D.W. 1984. Second Annual Report on the Limnology and Water Quality Monitoring Program at Crater Lake National Park, Oregon. Final. Crater Lake National Park. 24pp. + 2 figures + 7 tables + 14 appendices.

Larson, D.W. 1984. The Crater Lake Study: Detection of Possible Optical Deterioration of a Rare, Unusally Deep Caldera Lake in Oregon, U.S.A. Verh. Internat. Verein. Limnol. 22:513-517.

Loeb, S.L. and F.E. Reuter. 1981. The Epilithic Periphyton Community:A 5-Year Comparative Study of Community Productivity, Nitrogen Metabolism, Depth Distribution of Standing Crop. Verh. Internat. Verein. Limnol., 21:346-352.

Malick, J.G. 1971. Pupulation Dynamics of Selected Zooplankton in Three Oligothrophic Oregon Lakes. M.S. Thesis, Oregon State Univ., Corvallis, OR. 112pp.

Neal, V.T.,S.J. Neshyba, and W.W. Denner. 1971. Temperature Microstructure in Crater Lake, Oregon. Limnology and Oceanography. 16:695-700.

Neal, V.T., S.J. Neshyba, and W.W. Denner. 1972. Vertical Temperature Structure in Crater Lake, OR. Limnology and Oceanography. 17(3):451-453.

Nelson, C.H. 1961. Geological Limnology of Crater Lake, OR. M.S. Thesis, University of Minnesota, 175pp.

Pettit, E. 1936. On the Color of Crater Lake Water. Proceedings of the National Academy of Sciences. 22(2):139-146.

Phillips, K.N., A.S. Van Denburgh. 1968. Hydrology of Crater, East and Davis Lakes, OR. Geological Survey Water Supplypaper 1859-E. U.S. Gov. Pr.Off. 60pp.

Salinas, J.,T., et. al. Studies on Chemical Isotopic and Limnological Parameters of Crater Lake, Oregon. Eos., 65(45):885.

Simpson, H.J. 1970. Tritium in Crater Lake, OR. Journal of Geophysical Research. 75(27):5195-5207.

Smith, R.C., J.E. Tyler, and C.R. Goldman. 1973. Optical Properties and Color of Lake Tahoe and Crater Lake. Limnology and Oceanography. 18(2):189-199.

Soverign, H.E. 1958. The Diatoms of Crater Lake, OR. Transactions of the American Microscopy Society. 77(1):96-124.

Stohr-Gillmore, M.W. 1983. Envirnomental Management Appraisal of Crater Lake, Oregon. M.S. Thesis, University of Oregon, 101pp.

Thornton, E.S. 1965. Investigations At Crater Lake, Hydrologic Benchmark U.S. Geological Survey. Water Resources Division Bulletin. 23-26.

Tyler, J.E. 1965. In Situ Spectroscopy in Ocean and Lake Waters. Journal of the Optical Society of America. 55(7):800-805.

Utterback, C.L., L.D. Phifer, and R.J. Robinson. 1942. Some Chemical Planktonic and Optical Characteristics of Crater Lake. Ecology. 23(1):97-103.

Van Winkle, W. and N.M. Finbiner. 1913. Composition of the Water of Crater Lake, OR. Journal of Industrial Engineering Chemistry. 5(3): 198-199.

Wallis, O.L. 1948. Trout Studies and a Stream Survey of Crater Lake National Park, OR. M.S. Thesis, Oregon State College, Corvallis, OR. 124pp.

Wallis, O.L. and C.E. Bond. 1950. Establishment of Kokanee in Crater Lake, OR. Journal of Wildlife Management. 14(2):190-193.

Williams, D.L., and R.P. Von Herzen. On the Terrestrial Heat Flow and Physical Limnology of Crater Lake, OR. Journal of Geophysical Research.

Williams, H.and G. Goles. 1968. Volume of the Mazama Ash-Fall and the Origin of Crater Lake Caldera. Andesite Conference Guidebook. State of Oregon Dept. of Geology and Mineral Industries, Bulletin 62.

B. BOTANY

Agee, J.K. 1981. Biomass of Coniferous Understory Trees in Crater Lake National Park, Oregon. CPSU/UW 82-1. 29pp.

Applegate, E.I. 1939. Plants of Crater Lake National Park. American Midland Naturalist. 22(2):225-314.

*Colville, F.V. The Home of Botrychium pumicola. Bulletin of the Torrey Botanical Club. 28:109-111, with plate 7.

Colville, F.V. 1896. Ribes erythrocarpum, A New Currant from the Vicinity of Crater Lake, Oregon. Proceedings of the Biological Society of Washington. X:131-132.

Colville, F.V. 1897. Collomia mazama, A New Plant from the Vicinity of Crater Lake, Oregon. Proceedings of the Biological Society of Washington. XI:35-37.

Curtis, D.H. 1971. Myxomycetes New To Crater Lake National Park, Oregon.I. Madrona. 21(1)10-12.

Mueller, E.L. 1966. Introduction to the Ecology of the Pumice Desert, Crater Lake National Park, Oregon. M.S. Thesis, Purdue University, 110pp.

Pernot, J.F. 1916. Forests of Crater Lake National Park. USDI, GPO. 37pp.

Seyer, S.C. 1979. New Mosses From Crater Lake National Park, Oregon. The Bryologist. 82(1):82-83.

Seyer, S.C. 1979. Vegetative Ecology of a Montane Mine, Crater Lake National Park, Oregon. M.S. Thesis, Oregon State University. 187pp.

Seyer, S.C. and J.F. Franklin 1980. Sphagnum Bog: An Ecological Inventory and Recommendations for Management and Use. Report Submitted to the NPS, CRLA. 50pp.

Sipe, F.P. 1943. Lichens of Crater Lake National Park. Bryologist. 46(4):135-138.

Stuart, J.D. 1983. Stand Structure and Development of a Climax Lodgepole Pine Forest in South-Central Oregon. Ph.D. Thesis, University of Washington. 212pp.

Walsh, S.J. 1977. An Investigation Into the Comparative Utility of Color Infrared Aerial Photography and LANDSAT Data For Detailed Surface Cover Type Mapping Within Crater Lake National Park, Oregon. Oregon State University.

Wynd, F.L. 1930. Life Zones With Special Reference to the Botanical Features of Those of Crater Lake National Park. M.S. Thesis, University of Oregon, Eugene.

Wynd, F.L. 1936. The Introduced Flora of Crater Lake National Park. Torreya. 36:5-6.

Zeigler, R.S. 1978. The Vegetation Dynamics of Pinus contorta Forest, Crater Lake National Park, Oregon. M.S. Thesis, Oregon State University. 182pp.

Zobel, D.B. and R.S. Zeigler. No Date. Lodgepole Pine At Crater Lake: History and Management of the Forest Structure. NPS, Pacific Northwest Region, Seattle. Final Report, Contract No. CX-9000-6-0064. 49pp.

C. FIRE ECOLOGY

Agee, J.K. 1981. Fire Research Needs in National Park System Areas of Oregon and Washington. CPSU/UW 81-14. 24pp.

Agee, J.K. 1981. Initial Effects of Prescribed Fire in a Climax pinus contorta Forest, Crater Lake National Park. CPSU/UW 81-4 10pp.

Agee, J.K. and T.L. Thomas 1982. Forest Restoration at Sun Creek Crater Lake National Park. NPS, CPSU, Final Report, Contract CX-9000-1-E002. 38pp.

Gara, R.I., et.al. 1984. Influence of Fires, Fungi and Mounatin Pine Beetles on Development of a Lodgepole Pine Forest in South-Central Oregon. Prodeedings, Lodgepole Pine Symposium (in press).

McNeil, R.C. 1975. Vegetation and Fire History of Ponderosa Pine-White Fir Forest In Crater Lake National Park. M.S. Thesis, Oregon State University. 171pp.

McNeil, R.C. and D.B. Zobel 1980. Vegetation and Fire History of a Ponderosa Pine-White Fir Forest In Crater Lake National Park. Northwest Science. 54(1):30-46.

Mastrogiuseppe, R.J. 1982. Resource Management Implications of a Fire History and Prescribed Fire Effects Study of An Old-Growth Ponderosa Pine Forest, Crater Lake National Park, Oregon. Report to the Superintendent, Crater Lake National Park. 72pp.

Rabii, H.A. 1980. An Investigation of the Utility of Landsat 2 MSS Data to the Fire Danger Rating Area, and Forest Fuel Analysis Within Crater Lake National Park, Oregon. Ph.D. Thesis, Oregon State University. 410pp.

Thomas, T.L. 1982. Forest Restoration of Sun Creek, Crater Lake National Park. M.S. Thesis, University of Washington. 113pp.

D. ENTOMOLOGY

*Denning, D.G., The Genus Psychoglypha (Trichoptera: Limnephilidae). The Canadian Entomologist 102(1):15-30. (Two new species from Crater Lake National Park).

Stuart, J., et.al. 1983. Mountain Pine Beetle Scarring of Lodgepole Pine in South-Central Oregon. Forest Ecology and Management. 5:207-214.

E. HERPETOLOGY

Farner, D.S. 1947. Notes On the Food Habits of the Salamanders of Crater Lake, Oregon. Copeia. 4:259-261.

Farner, D.S. and J. Kezer. 1953. Notes on the Ampnibians and Reptiles of Crater Lake National Park. American Midland Naturalist. 50:448-462.

Kezer, J. and D.S. Farner. 1955. Life History Patterns of the Salamander ambystoma macrodactylum in the High Cascades Mountains of Sourthern Oregon. Copeia. 2:127-131.

F. MAMMALOGY

Hill, T. 1975 & 1976. The Ecology and Management of Elk In Crater Lake National Park, Oregon. Unpublished NPS Progress report. 21pp.

Huestis, R.R. Crater Lake Peromyscus. Journal of Mammalogy. 20(3):341-345.

Knuckles, D. 1973. The Food Habits Of Black Bear In Crater Lake National Park. Unpublished Report in Park Files. 13pp.

McCollum, M.T. 1972. Black Bear Study and Management Implications. Unpublished Progress Report in Park Files. 48pp.

McCollum, M.T. 1973. Elk, Their Ecology and Management. Crater Lake National Park. CRLA-N-15A

McCollum, M.T. 1973. Habitat Utilization and Movement of Black Bears in Southwest Oregon.
M.S. Thesis, Humboldt State College. 67pp.

Merriam, C.H. 1897. The Mammals of Mount Mazama. Mazama. 1(1)204-230.

Wallis, O.L. 1947. Mammals of Crater Lake National Park. M.S. Thesis, Oregon State University. 91pp

Wirtz, J.H. 1961. The Golden-Mantled Ground Squirrel, Citellus lateralis chrysodeirus (Merriam), Its Social and Community Interactions. Ph.D. Thesis, Oregon State University. 134.

G. ORNITHOLOGY

Farner, D.S. 1952. The Birds of Crater Lake National Park. University of Kansas Press. 187pp.

Follett, D. 1979. Birds of Crater Lake National Park. Crater Lake Natural History Association. 80pp.

H. GEOLOGY

Atwood, W.W., Jr. 1935. The Glacial History of an Extinct Volcano, Crater Lake National Park. Journal of Geology. 43(2):142-168.

Bacon, C.R. 1983. Eruptive History of Mount Mazama and Crater Lake Caldera, Cascade Range, U.S.A. Journal of Volcanology and Geothermal Research. 18:57-115.

Blank, H.R. 1968. Aeromagnetic and Gravity Surveys of the Crater Lake Region, Oregon. Andesite Conference Guidebook Bulletin 62. State of Oregon, Department of Geology and Mineral Industries, Portland, Oregon.

Briggs, L.J. 1962. When Mt. Mazama Lost Its Top. National Geographic, 122:138-148.

Fryxell, R. 1965. Mazama and Glacier Volcanic Ash Layers, Relative Ages. Science. 147:1288-1290.

Smith, W.D. and C.R. Swartzlow. 1936. Mount Mazama: Explosion Versus Collapse. Bulletin of the Geological Society of America. 47:1809-1830.

Tidball, R. 1965. A Study of Soil Development on Dated Pumice Deposits from Mt. Mazama, Oregon. Ph.D. Thesis. University of California.

Williams, H. 1942. The Geology of Crater Lake National Park, Oregon. Carnegie Institution of Washington Publication 540. 162pp.

Williams, H. 1961. Crater Lake, The Story of Its Origin. Univeristy of California Press. 97pp.

I. SOCIOLOGY

Schwarzkopf, S.K. 1984. Feeding of Golden-Mantled Ground Squirrels by Park Visitors At Crater Lake National Park. M.S. Thesis, Oregon State University/NPS,CPSU 84-9. 52pp.

Shelby, B. and D.W. Wolf. 1978. Design, Structure and Behavior: A Study of Visitors At Crater Lake National Park. Paper Presented At the Annual Meeting of the Rural Sociological Society, Contract. No. CX-9000-7-0061. Oregon State University and NPS. 17pp.

Thompson, T. J. 1976. Dispersed Winter Recreation Use Patterns and Visitor Attitudes, Crater Lake/Diamond Lake Area. Oregon State University, M.S. Thesis.

J. CULTURAL RESOURCES

Arbogast, D., et.al. 1982. Historic Structure Report, Crater Lake Lodge, Crater Lake National Park, Crater Lake, Oregon. DSC, NPS. 581pp.

Davis, W. A. 1963. Archeological Surveys of Crater Lake National Park and Oregon Caves National Monument, Oregon. Oregon State University/NPS Contract No.14-10-0434-900.

Greene, L.W. 1984. Historic Resource Study, Crater Lake National Park, Oregon. USDI, NPS, Denver Service Center. 318pp.

Schiltgen, L.(Ed.) 1984. Munson Valley, Crater Lake National Park, A Manual For Preservations, Redevelopment, Adaptive Use and Interpretation. University of Oregon. 107pp.

Smith, L. & L. 1982. A Chronological History and Important Events Log of Crater Lake National Park.

Steel, W.G. various dates. .William G. Steel Scrapbooks
Volumes I, II, and III. CRLA musuem
Various Authors:

Crater Lake Nature Notes - 2 volumes.
Volume 1 contains Volumes I-XIII.
Volume 2 contains Volumes XIV-XXII.

M. MANAGEMENT

NPS. 1977. General Management Plan-Crater Lake National Park. NPS, USDI.

NPS, DSC. 1982. Project Manual, Crater Lake National Park Rim Area, Crater Lake Lodge, Life Safety Improvements. NPS, DSC. (no p. numbered).

NPS, DSC. 1983. Environmental Assessment, Replacement of the Comfort Station Facilities at Cleetwood Cove Trail, Crater Lake National Park. NPS,DSC. 26pp.

NPS, DSC. 1984. Environmental Assessment, Rehabilitation of North Entrance Road, Crater Lake National Park, package 120. NPS, DSC. 27pp.

NPS, USDI, 1974. Wilderness Recommendation, Crater Lake National Park, Oregon. Denver Service Center Booklet. 24pp + 11pp.

NPS, USDI. 1984. Environmental Assessment, Development Concept Plan, Amendment to the General Management Plan. NPS, Denver Service Center. 71pp.

L. GENERAL

Cranson, K.R. 1982. Crater Lake Gem of the Cascades. K.R. Cranson Press. 111pp.

Harris, S.L. 1976. Fire and Ice - The Cascade Volcanoes. The Mountaineers - Pacific Search Press. 320pp.

Lapham, S.C. 1931. The Enchanted Lake: Mount Mazama and Crater Lake In Story, History and Legend. Portland, Oregon. J.K. Gill Co.

Toops, C. 1980. (1983 rev. by R. & B. Warfield). Crater Lake National Park Trails. Crater Lake Natural History Association. 48pp.

U.S. Geological Survey. 1956. Crater Lake National Park and Vicinity, Oreg. (1:62500 scale topographic map).

Warfield, R.G., et. al. 1982. Crater Lake, The Story Behind The Scenery. K.C. Publications, Las Vegas, Nevada. 48pp.